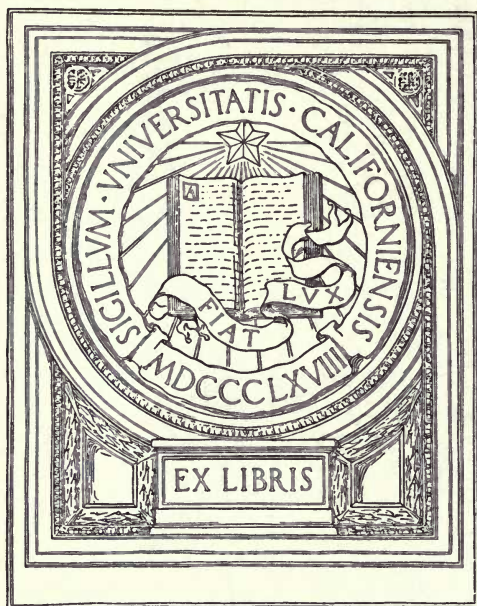


UC-NRLF



QB 197 107

SF
487
P4
1916



AGRIC.
LIBRARY

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE
CHAS. D. WOODS, DIRECTOR.

POULTRY MANAGEMENT AT THE MAINE
STATION

ORONO, MAINE
January, 1916.

(515-I-16)

University of Maine.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

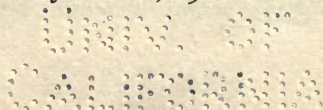
METHODS OF POULTRY MANAGEMENT AT
THE MAINE AGRICULTURAL
EXPERIMENT STATION.

(Revised to January, 1916.)

RAYMOND PEARL.

ORONO, MAINE.

JANUARY, 1916.



1916

	PAGE
Introduction	3
Poultry Hygiene and Sanitation.....	3
Poultry House Hygiene and Sanitation.....	4
Hygienic Feeding	9
The Land	12
Exercise	14
External Parasites	14
Disposal of Dead Birds.....	14
Isolation of Sickness.....	18
The Essentials of Poultry Hygiene.....	18
The Selection of Breeding Stock.....	19
Raising Chickens by Natural Processes.....	21
Raising Chickens by Artificial Processes.....	23
The Incubator	23
The Incubator Room	24
Brooder Houses	26
A Fresh Air Brooder.....	28
Construction of Fresh Air Brooder.....	33
Treatment of Young Chicks.....	36
Feeds and Feeding	37
Feeding Young Chickens.....	37
Feeding Chickens on the Range.....	42
The Feeding Trough	43
An Improved Range Feeding Trough.....	44
Feeding the Cockerels for Market.....	48
Feeding the Laying Pullets.....	51
Feeding the Hens, Cockerels and Cocks Kept Over Winter for Breeding Purposes	56
Green Food for Poultry.....	57
The Preparation of Green Sprouted Oats.....	59
Housing the Hens	64
The Roosting Closet House.....	65
The Abandonment of the Roosting Closet.....	66
Curtain Front Houses.....	67
Advantages of Curtain Front Houses.....	73
The Yards	75
Lice	77
Natural Enemies of Poultry.....	83
Trapnests	87
The Value, Method of Preservation, and Economical Use of Hen Manure	91
The Maine Station Manure Shed.....	94

DM

METHODS OF POULTRY MANAGEMENT AT THE
MAINE AGRICULTURAL EXPERIMENT STATION.

INTRODUCTION.

Many years' practical experience in raising and keeping poultry and investigations in poultry breeding at the Maine Experiment Station have resulted in the accumulation of a considerable fund of information on poultry management. It is the purpose of the following pages to outline this experience for the benefit of poultry keepers and thereby to help them to discriminate between some of the wrong theories which have underlain much of the common practice of the past and the better theories which underlie other and newer methods that are now yielding more satisfactory results. It may be that these methods are no better than those practiced by others, but the attempt is made to state concisely the methods which have been or are now being successfully employed at the Station.

POULTRY HYGIENE AND SANITATION.

Second in importance only to high constitutional vigor and health in the stock is attention to the basic rules of hygiene and sanitation in the management of poultry. This section gives an account of the general principles involved in the methods of dealing with these matters practised at the Maine Agricultural Experiment Station. Attention to the rules and principles here set forth will go a great ways towards preventing the occurrence of disease. This does not mean that if these rules are *not* followed disease and destruction will forthwith result. Everyone knows of plenty of instances of more or less successful poultry keeping under the most unsanitary and unhygienic of conditions. So similarly human beings are able when

forced to do so to live under unhygienic conditions. But every civilized country in the world believes that the most economical insurance against the steady loss of national wealth which the prevalence of disease involves is the enforcement of sanitary regulations throughout its domain. In poultry keeping many may be successful for a time in managing their birds in defiance of the laws of sanitation and hygiene; a *very few* may be successful in this practice for a long time, but in the long run the vast majority will find that thorough, careful, and intelligent attention to these laws will be one of the best guarantees of *permanent* success that they can find.

Poultry hygiene and sanitation will be considered here under seven main heads, as follows: 1. Housing. 2. Feeding. 3. The Land. 4. Exercise. 5. External Parasites. 6. Disposal of the Dead. 7. Isolation of Sickness. What is said under all of these heads is intended to apply (unless a specific statement to the contrary is made) both to adult birds and to chicks. No discussion of the hygiene of incubation, or of the relative merits of artificially and naturally hatched chickens will be undertaken here, because there are special subjects falling outside the field of general poultry hygiene.

I. POULTRY HOUSE HYGIENE AND SANITATION.

A. Cleanliness.—The thing of paramount importance in the hygienic housing of poultry is *cleanliness*. By this is meant not merely plain, ordinary cleaning up, in the housewife sense, but also bacteriological cleaning up; that is, *disinfection*. All buildings or structures of whatever kind in which poultry are housed during any part of their lives should be subjected to a most thorough and searching cleaning and disinfection once every year. This cleaning up should naturally come for each different structure (i. e., laying, colony or brooder house, individual brooder, incubator, etc.) at a time which just precedes the putting of new stock into this structure.

A very thorough method of cleaning a poultry house: Not every poultryman knows how to clean a poultry house thoroughly. The first thing to do is to remove all the litter and loose dirt which can be shovelled out. Then give the house—floor, walls and ceiling—a thorough sweeping and shovel out

the accumulated debris. Then play a garden hose, with the maximum water pressure which can be obtained, upon floor, roosting boards, walls and ceiling, until all the dirt which washes down easily is disposed of. Then take a heavy hoe or roost board scraper and proceed to scrape the floor and roosting boards *clean* of the trampled and caked manure and dirt. Then shovel out what has been accumulated and get the hose into action once more and wash the whole place down again thoroughly and follow this with another scraping. With a stiff bristled broom thoroughly scrub walls, floors, nest boxes, roost boards, etc. Then after another rinsing down and cleaning out of accumulated dirt, let the house dry out for a day or two. Then make a searching inspection to see if any dirt can be discovered. If so apply the appropriate treatment as outlined above. If, however, everything *appears* to be clean, the time has come to make it *really* clean by *disinfection*. To do this it is necessary to spray, or thoroughly wash with a scrub brush wet in the solution used, all parts of the house with a good disinfectant *at least twice*, allowing time between for drying. For this purpose 3 per cent cresol solution or 5 per cent formalin is recommended. The chief thing is to use an effective disinfectant and plenty of it, and apply it at least twice. A discussion of disinfectants immediately follows. To complete the cleaning of the house, after the second spraying of disinfectant is dry it is the practise at this Station to apply a liquid lice killer (made by putting 1 part crude carbolic acid or cresol with 3 parts kerosene) liberally to nests and roosts and nearby walls. After all this is done the house will be *clean*. In houses cleaned annually in this way the first step is taken towards hygienic poultry keeping.

The same principles which have been here brought out should be applied in cleaning brooders, brooder houses, and other things on the plant with which the birds come in contact.

What has been said has reference primarily to the annual or semi-annual cleaning. It should not be understood by this that no cleaning is to be done at any other time. On the contrary the rule should be to keep the poultry house *clean* at all times, never allowing filth of any kind to accumulate and using plenty of disinfectant.

Disinfection.—In the matter of disinfection there are several options open to the poultryman. He may make his own disinfectant, or he may purchase proprietary compounds, or he may buy a plain disinfectant like formaldehyde, or carbolic acid.

The Maine Agricultural Experiment Station has tried various disinfectants with a view to finding the most useful, when the factors of efficiency, ease of application and low cost, are considered. There is probably no more effective disinfectant than formaldehyde. The only objection to its use is that a man may find it difficult to withstand the fumes long enough to spray and scrub out thoroughly a pen. Formaldehyde is very good where it can be used, and there is no cheaper disinfectant, efficiency considered. The formaldehyde gas method for disinfecting poultry houses has recently been advocated, using the permanganate method of generating. This, however, is indicated only for rooms which can easily be closed up air tight. It costs too much in time and trouble to make any form of "fresh air" poultry house even moderately air tight. The formaldehyde gas method is well adapted to disinfecting and fumigating feed rooms, incubator cellars, brooder houses and all houses which can be readily made air tight. For the benefit of those who wish to use the method for such purposes the following directions are given. This will give a very strong fumigation and disinfection, but such is indicated about poultry establishments.

Formaldehyde Gas Disinfection: First make the room as tight as possible by stopping cracks, key-holes, etc., with pieces of cloth or similar substance. Use a metal or earthen dish for a generator, of sufficient size so that the liquid will not spatter or boil over on the floor, since the permanganate will stain. The temperature of the room should not be below 50° F. and more effective disinfection will be obtained if the temperature is 80° F. or above at the beginning. Sprinkle boiling water on the floor or place a kettle of boiling water in the room to create a moist atmosphere. Spread the permanganate evenly over the bottom of the dish and quickly pour in the formaldehyde (40 per cent strength as purchased). Leave and tightly close the room at once and allow to remain closed for 4-6 hours or longer, then air thoroughly." Use 23 ounces of per-

manganate and 3 pints of formaldehyde to each 1000 cubic feet of space.

For general disinfecting purposes about a poultry plant the Station has found one of the cheapest and most effective disinfectants to be compound cresol solution. This is used here for spraying and disinfecting the houses after they are cleaned, disinfecting brooders, brooder houses, incubators, nests and everything else about the plant which can be disinfected with a liquid substance. Any person can easily make this disinfectant. The following revised directions for its manufacture are quoted from Bulletin 179 of the Maine Agricultural Experiment Station.

Cresol Disinfectant.—The active base of cresol soap disinfecting solution is commercial cresol. This is a thick, sirupy fluid varying in color in different lots from a nearly colorless fluid to a dark brown. It does not mix readily with water, and, therefore, in order to make a satisfactory dilute solution, it is necessary first to incorporate the cresol with some substance like soap which will mix with water and will carry the cresol over into the mixture. The commercial cresol as it is obtained, is a corrosive substance, being in this respect not unlike carbolic acid. It should, of course, be handled with great care and the pure cresol should not be allowed to come in contact with the skin. If it does so accidentally the spot should be immediately washed off with plenty of clean water. The price of commercial cresol varies with the drug market.

Measure out 3 1-5 quarts of raw linseed oil in a 4 or 5 gallon stone crock; then weigh out in a dish 1 lb. 6 oz. of commercial lye or "Babbit's potash." Dissolve this lye in as little water as will completely dissolve it. Start with 1-2 pint of water, and if this will not dissolve all the lye, add more water slowly. Let this stand for at least 3 hours until the lye is completely dissolved and the solution is cold; then add the *cold* lye solution very slowly to the linseed oil, stirring constantly. Not less than 5 minutes should be taken for the adding of this solution of lye to the oil. After the lye is added continue the stirring until the mixture is in the condition and has the texture of a smooth homogeneous liquid soap. This ought not to take more than a half hour. Then while the soap is in this liquid state, and before it has a chance to harden add, with constant stirring, 8 1-2

quarts of commercial cresol. The cresol will blend perfectly with the soap solution and make a clear, dark brown fluid. The resulting solution will mix in any proportion with water and yield a clear solution.

Cresol soap is an extremely powerful disinfectant. In the Station poultry plant for general purposes of disinfecting the houses, brooder houses, incubators, nests, and other wood work, it should be used in a 3 per cent solution with water. Two or 3 tablespoons full of the cresol soap to each gallon of water will make a satisfactory solution. This solution may be applied through any kind of spray pump or with a brush. Being a clear watery fluid it can be used in any spray pump without difficulty. For disinfecting brooders or incubators which there is reason to believe have been particularly liable to infection with the germs of white diarrhea or other diseases the cresol may be used in double the strength given above and applied with a scrub brush in addition to the spray.

B. Fresh Air and Light.—Too great stress cannot be laid on the importance of plenty of fresh air in the poultry house if the birds are to keep in good condition. And it must be remembered in this connection that “fresh” air, and cold stagnant air are two very different things. Too many of the types of curtain front and so-called “fresh air” houses now in use are without any provision other than an obliging southerly wind, to insure the circulation or changing of air within the house. Even with an open front house it is wise to provide for a *circulation* of air in such way that direct drafts cannot strike the birds. This applies not only to the housing of adult birds in laying houses, but also to the case of young stock in colony houses on the range. Further a circulation of fresh air under the hover in artificial rearing is greatly to be desired and will have a marked effect on the health and vigor of the chicks.

Not only should the poultry house be such as to furnish plenty of fresh air, but it should also be *light*. The prime importance of sunlight in sanitation is universally recognized by medical authorities. Disease germs cannot stand prolonged exposure to the direct rays of the sun. Sunlight is Nature’s great disinfectant. Its importance is no less in poultry than in human sanitation. The following statement made some years ago (1904) by a writer signing himself “M” in *Farm Poultry*

(Vol. 15) brings home in a few words the importance of having plenty of light in the poultry house.

"Light in the poultry house has been found by the writer a *great help in keeping the house clean and keeping the fowls healthy*. Probably there is no greater assistance to the diseases of poultry than dark and damp houses, and dark houses are frequently damp. In recent years I have had both kinds of experience, those with the hens confined in a large, dry and light house, and with hens confined in a dark house in which a single window looking towards the setting sun furnished the only light. Being forced to use the latter building for an entire winter I found it impossible to get it thoroughly dried out after a rain had rendered the walls damp. By spring some of the fowls that had been confined there began to die of a mysterious disease and a post-mortem examination showed it to be liver disease. Later the roup broke out in the same house and this dread disease continued with the flock for months exacting a heavy toll in laying hens."

C. Avoid Dampness. Of all unfavorable environmental conditions into which poultry may, by bad management, be brought, a damp house is probably the worst. Nothing will diminish the productivity of a flock so quickly and surely as will dampness in the house, and nothing is so certain and speedy an excitant to roup and kindred ills. *The place where poultry are housed must be kept dry if the flock is to be productive and free from disease.*

D. Provide Clean and Dry Litter. Experience has demonstrated that the best way in which to give fowls exercise during the winter months in which, in northern climates at least, they must be housed the greater part if not all of the time, is by providing a deep litter in which the birds scratch for their dry grain ration. For this litter the Experiment Station uses pine planer shavings with a layer of oat straw on top. Whatever the litter it should be changed as often as it gets damp or dirty.

II. HYGIENIC FEEDING.

Along with housing as a prime factor in poultry sanitation goes feeding. This is not the place to enter upon a detailed discussion of the compounding of rations and such topics.

These matters are considered farther on in this circular (see pages 39-64). There are, however, certain basic principles of hygienic feeding which must always be looked after if one is to avoid diseases. These are:

A. Purity. It should be a rule of every poultryman never to feed any material which is not clean and wholesome. Musty and mouldy grain, tainted meat scraps or cut bone, table scraps which have spoiled, and decayed fruits or vegetables should never be fed. If this consideration were always kept in mind many cases of undiagnosed sickness and deaths, and low condition in the stock would be avoided. Keep all utensils in which food is placed *clean*.

B. Avoid Overfeeding. Intensive poultry keeping involves of necessity heavy feeding, but one should constantly be on the lookout to guard against overfeeding, which puts the bird into a state of lowered vitality in which its natural powers of resistance to all forms of infectious and other diseases are reduced. The feeding of high protein concentrates like linseed or cotton seed meal needs to be particularly carefully watched in this respect.

C. Provide Plenty of Green Food. Under natural conditions poultry are free eaters of green grass and other plants. Such green food supplies a definite need in metabolism, the place of which can be taken by no other sort of food material. It is not enough merely to supply *succulence* in the ration. Fowls need a certain amount of succulent food, but they also need *fresh green food*. It is desirable to provide for a succession of green food throughout the year. The succession followed at the Maine Agricultural Experiment Station is as follows:

Beginning in the early fall when the pullets are put in the laying house they are given green corn fodder cut fine in a fodder cutter. Stalks, leaves and ears are cut together in pieces averaging about 1-2 inch in length. The birds eat this chopped corn fodder greedily. It is one of the best green foods for poultry that we have as yet been able to find. Its usefulness is limited only by the season within which it is possible to get it. The feeding of corn fodder is continued until the frost kills the plants.

When the corn can no longer be used cabbage is fed. The supply of this usually lasts through December. In the event of the supply of cabbage failing before it is desirable to start the oat sprouter (see p. 59) the interval is filled out by the use of mangolds. From about January 15 to May 15 green sprouted oats grown as described below (pp. 59-64) form the source of green food. From about May 15 until the corn has grown enough to cut, fresh clover from the range is used. During the summer the growing chicks on the range are given rape (Dwarf Essex) and green corn fodder cut, as described above to supplement the grass of the range, which rather rapidly dries out and becomes worthless as a source of green food under our conditions. The very young chicks in the brooders are given the tops only of green sprouted oats chopped up fine.

D. Provide Fresh and Clean Drinking Water. The most sure and rapid method by which infectious diseases of all kinds are transmitted through a flock of birds is by means of the water pail from which they all drink in common. Furthermore the water itself may come from a contaminated source and be the origin of infection to the flock. Finally it is difficult to devise any satisfactory drinking fountain in which the water is not liable to contamination from litter, manure, etc. All these considerations indicate the advisability of adding to all drinking water which is given to poultry some substance which shall act as a harmless antiseptic. The best of all such substances yet discovered for use with poultry is potassium permanganate. This is a dark reddish-purple crystalline substance which can be bought of any druggist. It ought never to cost more than 20c-30c per pound and a pound will last for a long time. It should be used in the following way: In the bottom of a large mouthed jar, bottle or can, put a layer of potassium permanganate crystals an inch thick. Fill up the receptacle with water. This water will dissolve all of the crystals that it is able to. This will make a stock saturated solution. As this solution is used add more water and more crystals as needed, always aiming to keep a layer of undissolved crystals at the bottom. Keep a dish of stock solution like this alongside the faucet or pump where the water is drawn for the poultry. *Whenever any water is drawn for either chicks or adult fowls at the Maine Agricultural Experiment Station enough of the stock solution is*

added to give the water a rather deep wine color. This means for some 4 years past no bird has ever had a drink of water from the time it was hatched which did not contain potassium permanganate, except such water as it got from mud puddles and the like.

III. THE LAND.

One of the most important considerations in poultry sanitation is to keep the ground on which the birds are to live, both as chicks and as adults, from becoming foul and contaminated. This is not a very difficult thing to do if one has enough land and practices a definite and systematic crop rotation in which poultry form one element. On the open range where chicks are raised a four year rotation is operated at the Maine Agricultural Experiment Station and serves its purpose well. This system of cropping is as follows: First year, chickens; second year, a hoed crop, such as beets, cabbage, mangolds or corn; third year, seed down to timothy and clover, using oats or barley as a nurse crop; fourth year, chickens again. Other cropping systems to serve the same purpose can easily be devised.

1 to 2 teaspoons of the stock solution to 10 quarts of water. At the same time one should clean and disinfect the drinking pails and fountains regularly, just as he would if he were not using potassium permanganate. At the Maine Station plant

To maintain the runs connected with a permanent poultry house, where adult birds are kept, in a sweet and clean condition is a more difficult problem. About the best that one can do here is to arrange alternate sets of runs so that one set may be used one year and the other set the next, purifying the soil so far as may be by annually plowing and harrowing thoroughly and planting exhaustive crops. Failing the possibility of alternating in this way, disinfection and frequent plowing are the only resources left.

The following excellent advice on this subject is given by the English poultry expert Mr. E. T. Brown (*Farm Poultry*, Vol. 18, p. 294): "Tainted ground is responsible for many of the diseases from which fowls suffer, and yet it is a question that rarely receives the attention it deserves. The chief danger of tainted soil arises when fowls are kept in confinement, but still we often find that even with those at liberty the land over which

they are running is far from pure. So long as the grass can be kept growing strongly and vigorously there is small fear of foul ground, as the growth absorbs the manure; it is when the grass becomes worn away that the chief danger arises. The manure constantly falling upon the same small area, and there being nothing to use it up, the land is bound in a short space of time to become so permeated as to be thoroughly unfit for fowls. The question is very often asked in connection with this subject as to how many fowls a certain sized piece of land will accommodate the whole year through. Occasionally one may see in some of the agricultural or poultry journals this question answered, but as a matter of fact to give any stated number is most misleading. It depends very largely upon the class of soil, as some can carry twice as many birds as others; it depends upon the breed of poultry, some being much more active than others, and thus requiring more space; it depends, too, upon the time of year, because during the spring and summer, when there is an abundance of vegetable growth in the soil, a considerably larger number of birds can be maintained than during the autumn or winter. The number must be varied according to these circumstances, and no hard and fast rule is applicable."

"The results of tainted ground are generally quickly noticeable, as the fowls have a sickly appearance, the feathers lose their brilliant lustre, and the wings begin to droop. Roup, gapes, and other ailments speedily show themselves, causing, if not death itself, considerable loss and unpleasantness. One of the greatest advantages to be derived from portable houses is that they so greatly reduce the risk of tainted ground, as they are being constantly moved from one place to another, thus evenly distributing the manure. When it is remembered that each adult fowl drops nearly a hundred weight of manure in the course of a year, the importance of this question will be immediately realized. It is quite possible, however, provided that suitable precautions are taken, to keep a comparatively small run pure for a long time. If the grass is short it should be occasionally swept, in this manner removing a good deal of the manure. Another important point is to always have around the house a space of gravel, upon which the birds should be fed, and if swept once or twice a week this will have a wonderful effect in preserving the purity of the grass portion. Anyone

who has observed poultry will know how fond they are of constantly being near the house, and thus the greater portion of their droppings falls within its immediate vicinity. The shape of the run also has a great bearing upon the length of time it will remain untainted, a long narrow run being much superior to a square one. I have proved by my own experience how true this is, and probably a long and narrow run, containing the same amount of space will remain pure twice as long. It is unnecessary here to go into a full explanation of why this is so, but I may state the fact, which I am confident is quite correct. If the space at one's disposal is very limited it is a good plan to divide it into two equal parts, placing the house in the middle. During one year one-half would be available for the fowls, the other being planted with some quickly growing vegetables, the order being reversed the year following. The vegetable growth has the effect of quickly using up the manure, and in this manner quite a small plot of land can be heavily stocked with poultry for an unlimited number of years."

IV. EXERCISE.

If poultry are to be in good condition, and maintain their normal resistance to disease *they must exercise*. As chicks they will do this on the range. As adults (in climates like that of Maine) the most feasible way to bring this about is to provide litter and make the birds scratch for their feed.

V. EXTERNAL PARASITES.

In hygienic poultry keeping the birds must be kept reasonably free at all times of lice, mites, and all other forms of external parasites. The methods of dealing with this matter in use at this Station are given in detail farther on. It is desired here merely to call attention to the matter as one of the general principles of hygienic poultry management.

VI. DISPOSAL OF DEAD BIRDS.

On every poultry plant and around every farm there are bound to occur from time to time a greater or less number of deaths of chickens and adult fowls from disease or other natural causes. The disposal of these dead bodies offers a problem to

the poultryman, the correct solution of which may in many cases become a very important matter. This is especially true in the case of death from contagious diseases, which include a considerable proportion of the deaths of poultry generally. The method usually practiced by the farmer and poultryman for the disposition of dead carcasses is unsanitary in the extreme. To throw the dead bodies on the manure pile is to invite the spread of disease on the plant. Burying is far from being a satisfactory way of dealing with the matter for two reasons. Unless the grave is dug deep, which costs a good deal of time and labor, there is considerable likelihood that dogs or other marauding animals will dig out the carcasses, and, after feeding on them, scatter the remains around on the top of the ground. Furthermore, burying cannot be resorted to at all during the winter months when the ground is frozen.

The only really sanitary method of dealing with dead bodies is to incinerate them. The difficulty of following this plan in practice is that the farmer or poultryman usually does not have any suitable source of heat ready at hand at all times. To be sure, during certain seasons of the year, those poultrymen who employ large brooder houses with a hot water heating system have a furnace in operation, and the dead chicks can be burned up in the furnace. This, however, covers only a part of the year. At other times resort must be had to burying or some other means of disposal, as the poultryman is not likely to fire up a large furnace for the sake of burning a few dead birds.

At the Station plant it was felt to be desirable to have a small crematory conveniently located, and so easy and economical of operation that dead birds could be disposed of immediately, with a minimum amount of trouble and labor. To meet this requirement there was devised the small crematory here described. The construction was carried out with the idea of keeping the first cost as low as possible, in order that there should be nothing about it which any poultryman or farmer could not easily afford to duplicate. As a matter of fact, the cost of materials for the crematory here described was less than ten dollars. The labor was done by the poultryman and his assistant at odd times, when an hour or two could be spared for this work. The result is therefore, not beyond the reach of any poultryman or farmer. At the same time the crematory is so satisfactory in operation

that anyone who builds one will wonder, after he has completed and used it for a time, why he did not long before have so simple and sanitary an adjunct to his plant.

The crematory shown in Figure 1 is very simple in construction. It consists essentially of a cement base or fire box, bearing on its top a series of grate bars which are in turn covered by a cremating box or oven in which the material to be incinerated is placed.

The crematory here described is sufficiently large to take care of all the needs of a plant carrying 1000 head of adult stock, raising 3000 to 4000 chickens annually, and in which a good deal of anatomical and physiological research is going on, necessitating a much larger amount of waste animal material than the ordinary commercial poultryman would have. Therefore, it is doubtful if it would be necessary in any but the very largest commercial plants to build a larger crematory than the one here described.

In building this an excavation was first made for the base, in which a lot of loose stones and gravel were placed, in order to secure adequate drainage below the cement. On top of this the cement base and fire box were made.

This base consists essentially of a rectangular box made of cement open at the top, and with a small opening in front through which the fire is fed and which serves as a draught. The walls are about 6 inches thick. The outside dimensions of the fire box base are 3 feet, 4 inches by 2 feet, 6 inches. The inside dimensions of the fire box are 2 feet, 3 inches by 1 foot, 9 1-2 inches by 1 foot, 4 inches. Across the top of the fire box there were laid, while the cement was still soft, some old grate bars from a small steam boiler, which had been discarded and thrown on the dump heap. These were set close together and held firmly in place when the cement hardened. They form the grate on which the material to be incinerated is thrown. These old boiler grate bars, besides costing nothing, had another advantage; namely that of their thickness and weight. When they become thoroughly heated from the fire below they will hold the heat for a considerable time charring and burning the animal material above.

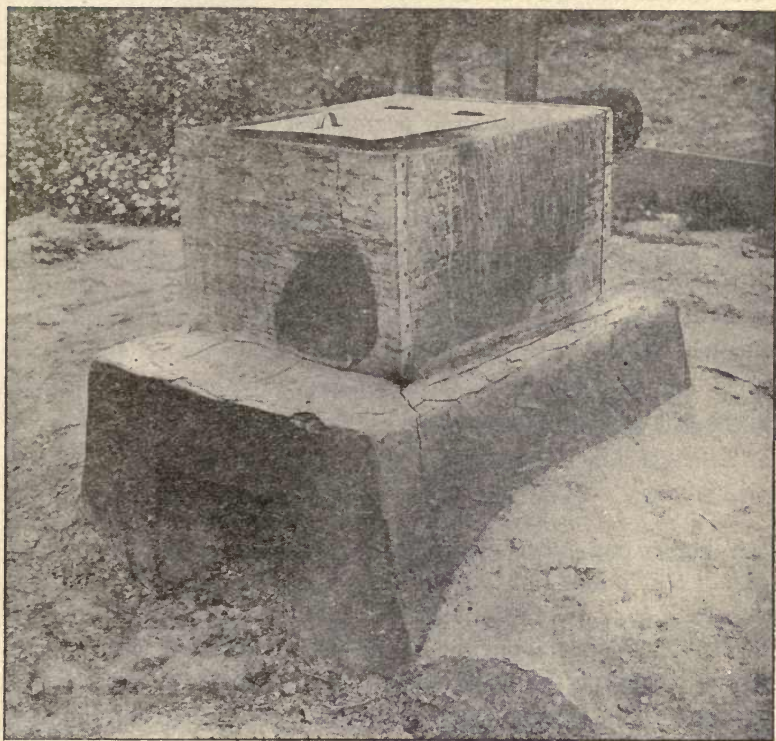


Fig. 1. Photograph of crematory described in text. Note cement base, with opening in front into fire box; galvanized iron cremating box on top; cover of cremating box.

The incinerating chamber proper was made from galvanized iron by a local tinsmith. This consists of a rectangular box having the following dimensions: Length 2 feet, 2 inches; width 1 foot, 10 inches; height 1 foot, 6 inches. In the top of this is cut a round hole, 12 inches in diameter which is protected by a hinged cover 15 inches by 14 1-2 inches. This galvanized box has no bottom. It is placed on top of the grate bars, and held firmly in place by cement worked up around its lower edges. At the back end of this iron cremating box is an opening for a stove pipe, which is necessary in order to give the proper draught. It is found in practice that only a short piece of stove pipe is necessary to get sufficient draught to make a very hot fire, which entirely consumes the birds in a few hours.

The funnel may best be left removable so that when the crematory is not in use it can be taken off and stored inside the wooden box (which then sets over the galvanized iron portion to protect it from the weather.

It is important in locating a crematory of this kind to plan matters so that there will be good drainage from around it. In particular pains should be taken to insure that water does not run into the firebox and freeze during the winter.

In operation the apparatus works as follows: Dead birds are thrown into the incinerating chamber through the opening in the top and the lid closed while a wood fire is burning in the fire box below. The aim should be to use dry wood and get a quick and very hot fire. This first roasts the material and then chars it, and finally reduces it to fine ashes.

VII. ISOLATION OF SICKNESS.

Whether one expects to treat the bird or to kill it, *every individual that shows signs of sickness should be removed from the general flock*. When the bird has been isolated a decision as to what will be done about the case can be reached at leisure, and in the meantime the flock is not subjected to the danger of infection. This is an important matter with young chickens as well as with adult stock.

The general subject of the diagnosis, etiology and treatment of poultry diseases is not discussed in the present work. Those desiring information regarding these matters should consult the book on this subject prepared by the present writer and his associates.*

THE ESSENTIALS OF POULTRY HYGIENE.

To summarize this discussion of poultry hygiene and sanitation it may be said that the essentials in the hygienic and sanitary management of poultry are

1. CLEAN HOUSES.
2. CLEAN AIR.

Pearl, Surface, and Curtis. The Diseases of Poultry. New York, (published by the Macmillan Co.) 1915.

3. CLEAN FOOD.
4. CLEAN WATER.
5. CLEAN YARDS AND CLEAN RANGE.
6. CLEAN INCUBATORS AND BROODERS.
7. CLEAN BIRDS, OUTSIDE AND INSIDE.

THE SELECTION OF BREEDING STOCK.

At the Maine Agricultural Experiment Station the poultry plant is conducted for purely experimental purposes in connection with the study of the principles of breeding. On that account the considerations which determine the choice of birds to go into the breeding pens are somewhat different to what they would be in a purely commercial plant. It will therefore be advisable to discuss here only those general guiding principles in regard to the selection of breeding stock, which the experience of this Station has demonstrated to be of fundamental importance in building up an economically productive strain of poultry.

Whatever the object of the breeder, whether egg production, table fowl production, or the fancy, the first selection of breeding stock should be for constitutional vigor and vitality. No bird which shows the slightest sign of weakness or lack of vigor should be used as a breeder. The selection for constitutional vigor should begin at a very early age and be continued until the pens are mated. It is a great mistake to leave the whole of the process of selection until just prior to the breeding season. As the chicks are growing on the range the most vigorous ones, those which impress themselves in the eye of the breeder as surpassing their associates in vitality, rate of growth, vigor, etc., should be marked and watched. With later development some of these early selected birds will fail to fulfill the promise of their youth and will then be discarded. Others which were not conspicuously excellent at an early age will develop into unusually good specimens later. They may then be taken into the selected group. Finally as the mating season approaches the breeder should go carefully over this group of birds which have been selected from the beginning of their lives, and pick out the most vigorous of the lot which also carry the other qualities for which he is breeding. The

point is to make the selection of breeders a process of continuous picking out the good and culling the poor throughout the entire growth of the birds.

Another point of importance is in relation to the size of the breeding stock. It is a nearly universal experience, if line breeding be practised for any particular character, as for example egg production or feather marking, that unless special attention is paid to this point there will tend to be a progressive deterioration in the average size of the birds. This is particularly liable to happen when one is breeding for egg production. To counteract this tendency special attention must be paid to the size of the breeding stock, making it a rule never to use as a breeder any bird, whatever the other excellencies may be, which does not attain a certain weight standard set by the breeder.

What has been said regarding size is only a special case of the general rule of breeding that always the effort in selecting breeders should be towards all-round excellence. Selection for any one character alone—as for example egg production—with an entire disregard of all other characters of the birds will, in comparatively few generations, defeat its own end. It will be found that the stock has deteriorated quite as much in regard to some important qualities as it may have gained in respect to the character for which selection was made.

While it is not possible here to enter upon an exhaustive discussion of the subject of breeding for egg production a word may be said regarding the results of the Maine Agricultural Experiment Station along this line. From long continued experiments it appears to be conclusively demonstrated that the male bird has a hitherto unsuspected importance in the transmission of high-laying qualities to the progeny. Egg production, in the Barred Plymouth Rock fowl at least, appears to depend upon two separately inherited physiological factors. Either of these factors when present alone in a bird makes it a poor or mediocre layer. If both factors are present together the bird is a high producer. The novel feature of the case lies in the point that the factor upon which high production depends (i. e., which must be present if the bird is to be a high producer) is never transmitted in inheritance from a mother to her daughters, but only to her sons. It behaves, in other words

as a sex-linked character. The male bird which possesses this hereditary factor for high production may however transmit it both to his sons and his daughters. It thus appears that the high egg productiveness exhibited by some pullets or hens is always directly inherited from the sire, and not at all *directly* from the dam, though the sire himself may very likely have inherited the quality from his dam. Indeed the male which is hereditarily pure (homozygous) with respect to this high producing factor must receive one half of his endowment from his dam. The practical significance of this matter is that more attention will have to be paid to the male birds in breeding for egg-production than has hitherto been the case. Only males from high-laying dams should be used as breeders and of those only a portion will transmit high producing qualities to any large proportion of the daughters. An important practical step is to toe-mark, or otherwise identify, all pullets so that their *sire* may be known. From their performance the breeder will be able to judge of the ability of the sons of this sire (the brothers of the pullets) to transmit high-producing qualities.*

RAISING CHICKENS BY NATURAL PROCESSES.

While even the small grower of chickens in many cases uses an incubator for hatching, circumstances make it necessary at times to hatch and raise chickens by aid of the mother hen. To persons so situated an outline of the method practiced at the Station before incubators had reached their present development may be helpful. An unused tie-up in a barn was taken for the incubating room and a platform was made along the inner side. The platform was 3 feet above the floor and was 2 1-2 feet wide and 50 feet long. It was divided into fifty little stalls or nests, each 1 foot wide, 2 feet long, and 1 foot high. This left a 6-inch walk along the front of the nests for the hens to light on when flying up from the floor. Each nest had a door made of laths at the front, so as to give ventilation. The door was hinged at the bottom and turned outward. Across the center of each nest a low partition was placed, so that the nesting material would be kept in the back end—the

*A detailed report of the experiments on the basis of which the above statements are made is published as Bulletin 205 of the Maine Agricultural Experiment Station.

nest proper. For early spring work paper was put in the bottom of the nest, then an inch or two of dry earth, and on that the nest, made of soft hay.

Whenever half a dozen hens became broody they were taken in from the henhouse and put on the nests, each nest having a dummy egg in it; the covers were then shut up, and nearly every hen seemed contented. In a day or two 13 eggs were placed under each hen. Every morning the hens were liberated as soon as it was light, when they would come down of their own accord and burrow in the dry dust on the floor, eat, drink, and exercise, and in twelve or fifteen minutes they would nearly all go back to the nests voluntarily. In the afternoons one would occasionally be found off the eggs looking out through the slatted door. If she persisted in coming off she was exchanged for a better sitter. The double nest is necessary, otherwise the discontented hen would have no room to stand up, except on her nest full of eggs, and she would very likely ruin them. There was no danger of this with the double nest, as she would step off the nest, go to the door and try to get out.

The advantages of a closed room in which to confine the sitters are many, as the hens are easily controlled and do not need watching as they do when selecting nests for themselves, or when sitting in the same room with laying hens. A room 12 feet square could be arranged so as easily to accommodate 50 sitters.

The most satisfactory arrangement used at the Maine Station for the accommodation of the hen with her brood of young chicks consisted of a closed coop about 30 inches square, with a hinged roof and a movable floor in two parts, which would be lifted out each day for cleaning. This little coop had a wire-covered yard attached to it on the south side. The yard was 4 by 5 feet in size and 1 1-2 feet high. Its frame was of 1-inch by 3-inch strips and was fastened securely to the coop.

The wire on the sides was of 1-inch mesh, but on top 2-inch mesh was sufficient. Such a coop is easily kept clean, and the coop and yard can be set over upon clean grass by one person.

The small run will be sufficient for the first few weeks, but soon the chicks need greater range, and then the fence at the farther end of the run can be lifted up 3 or 4 inches and they can pass in and out at will, while the mother will be secure at

home and they will know where to find her when they get cold or damp or need brooding. Such a coop accommodates 15 to 20 chicks until they no longer require brooding, after which several flocks should be combined in one and put in a portable house on a grassy range.

Whenever the hen is allowed to hatch or to mother chicks, much care must be exercised to prevent lice from getting a foothold and ruining the birds. The free and frequent use of the lice powder described farther on (p.), working it through the feathers to the skin, is one of the best methods for destroying the pests. Grease or oil is effective when applied to the heads and under the wings of young chicks, but care must be taken not to get too much on them, especially during damp weather. The feeding of chicks raised in coops with their mothers does not vary much from the feeding of those raised in brooders as described below.

RAISING CHICKENS BY ARTIFICIAL PROCESSES.

Incubators have been much improved and there are several kinds on the market that will hatch about as many chicks from a given lot of eggs as can be done by selected broody hens. Furthermore, in the experience of this Station, with proper management during and subsequent to incubation the chicks so produced are *fully* the equal in constitutional vigor, average duration of life, and productivity, of hen-hatched chicks. The best present day incubators require little care, maintain an even temperature arising from the development of the embryos going on in the eggs. In some machines the moisture supply is automatic and adapted to the requirements; in others it has to be supplied, and skill is necessary in determining the quantity needed. The economy of the incubator is very great. A 360-egg machine will do the work of nearly 30 broody hens, and can be kept at work continually if desired. For more than 10 years past all chicks in the Maine Experiment Station's poultry plant have been hatched in incubators. There has yet to appear any reason for going back to the old system of hatching with hens.

THE INCUBATOR.

There are many makes of incubators on the market, some of which will give satisfactory results. The Maine Station

has not tested many makes of incubators, and very likely some of the makes not tested would prove as satisfactory as those used.*

Whatever make of incubator is used, pains should be taken to become thoroughly acquainted with the machine before the eggs are put into it. It is advisable for a person not familiar with the use of an incubator to run the machine empty for several days before filling it. After the eggs are put in, changes and adjustments should be made with the greatest care for fear of extreme results. By the use of an incubator it is possible to determine exactly the time when the chickens shall be hatched. With the strain of Barred Plymouth Rocks bred by the Maine station it was formerly necessary to hatch the chickens in March in order to have them ready for November laying. By better methods of feeding, breeding, and treatment, it is now possible to delay the hatching until April and the first of May and have the pullets in good laying condition the last of October and early in November. Chickens hatched in March under the present method of breeding and feeding would in many cases begin laying in August.

THE INCUBATOR ROOM.

It is important that the incubator room be so situated that it can be kept at a fairly constant temperature. On this account an underground room is usually selected. For many years the well-lighted cellar under the wing of the farmhouse was used by the Maine Station. A cold or badly ventilated cellar would, however, be poorly adapted for incubators. Ventilation is very important, and where several incubators are in use artificial ventilation must be provided, in order that the machines may be furnished with clean, fresh air at all times.

In 1905 the Maine Station erected an incubator house which practically consists of a well-made, light, airy cellar with a house for the poultry man above it. The incubator room, which occupies the entire cellar, is 30 feet square. The room is 7 feet

*A discussion of the different types of incubators and the methods of managing them to get the best results is given in Farmers' Bulletin 236, "Incubation and Incubators," which may be obtained free on application to the Secretary of Agriculture, Washington, D. C. The directions furnished by the manufacturers of the different incubators should be strictly adhered to by the beginner.

high in the clear, 5 feet of which is below the level of the outside ground. It is lighted by six 3-light windows, carrying glass 10 inches by 16 inches. The cement walls are finished smooth and the cement floor is slightly inclined toward the southeast corner where the intake of the drain is located. This enables the free use of water from hose in cleaning the room preparatory to starting the incubators. Two chimneys extend to the basement floor and contain ventilating flues that have no opening into the rooms above. Entrance to the room is through a covered outside cellar stairway leading into a shed at the rear of the building. The room now contains thirteen 360-egg machines.

In the directions which accompany certain of the incubators which have been used at the Station it is stated that an artificial source of moisture is not needed in operating these incubators except in very arid parts of the country. It is said that in other places the normal moisture of the atmosphere is sufficient to insure the necessary moisture in the incubator. The experience of the Station indicates that except possibly in a rather wet season this is not the case. It has been found here that in an ordinary season if no artificial moisture is supplied to the incubators there is too great an evaporation from the eggs. It is demonstrable that many eggs fail to hatch because of this dryness of the air in the incubator. It is not desirable here to enter into a detailed discussion regarding experiments on this point. It suffices to state the fact that in the Station's experience better hatches have been obtained when moisture beyond that normal in the atmosphere is supplied during incubation. The most satisfactory way to supply this extra moisture in machines where sand trays are not an integral part, has been found to be by sprinkling the eggs with warm water twice a day. The water is warmed to a temperature of from 104°-108° Fahr. The sprinkling may be done either with a small hand sprayer or by simply shaking the water on with the hand or a whisk broom. This is done in connection with the regular manipulation of the eggs (cooling and turning) during incubation. The application of moisture is begun as soon as the eggs go into the machine and is continued until the 18th day. Since adopting this procedure a very considerable reduction in the mortality of chicks in the shell has been effected.

BROODER HOUSES.

Some years ago there was erected at this Station a long continuous brooder house, containing 10 brooders and with capacity for 600 to 1000 chicks. This house burned during the first season of its use, and has never been replaced.

A permanent brooder house would be indispensable for the raising of winter chickens, and a house piped for hot water has some advantages. The advantages are especially great when raising chickens if April or May proves to be cold or wet, for then the small houses are apt to be cold outside of the brooders. In ordinary seasons, even in Maine, little or no difficulty is experienced in raising chicks hatched in April and May in the small houses. The expenditure would be greater for the piped house, for the reason that colony houses still must be provided in which the chicks may be sheltered after they leave the brooder house.

Since the burning of the house just described, the Maine Station has used small portable brooder houses (see fig. 1). The small brooder houses built on runners are readily moved about, and for the work with spring-hatched chickens are preferred to the large permanent brooder house. Several styles and sizes have been used, but the following meets the needs of the Station better than any other that has been tried. The houses are built on two 16-foot pieces of 4 by 6 inch timbers, which serve as runners. The ends of the timbers, which project beyond the house, are chamfered on the underside to facilitate moving. The houses are 12 feet long; some of them are 6 feet and others 7 feet wide; 7 feet is the better width. They are 6 feet high in front and 4 feet high at the back. The frame is of 2 by 3 inch lumber; the floor is double boarded, and the building is boarded and covered with a good quality of heavy roofing paper. Formerly shingles were used for the outside covering, but paper is preferred and is now used exclusively. This kind of covering for the wall is not so likely to be injured in moving as shingles. A door 2 feet wide is in the center of the front and a 6-light window, hinged at the top, is on each side of it. Two brooders are placed in each of these houses and 50 to 60 chicks are put with each brooder. A low partition separates the flocks while they are young. The houses are large

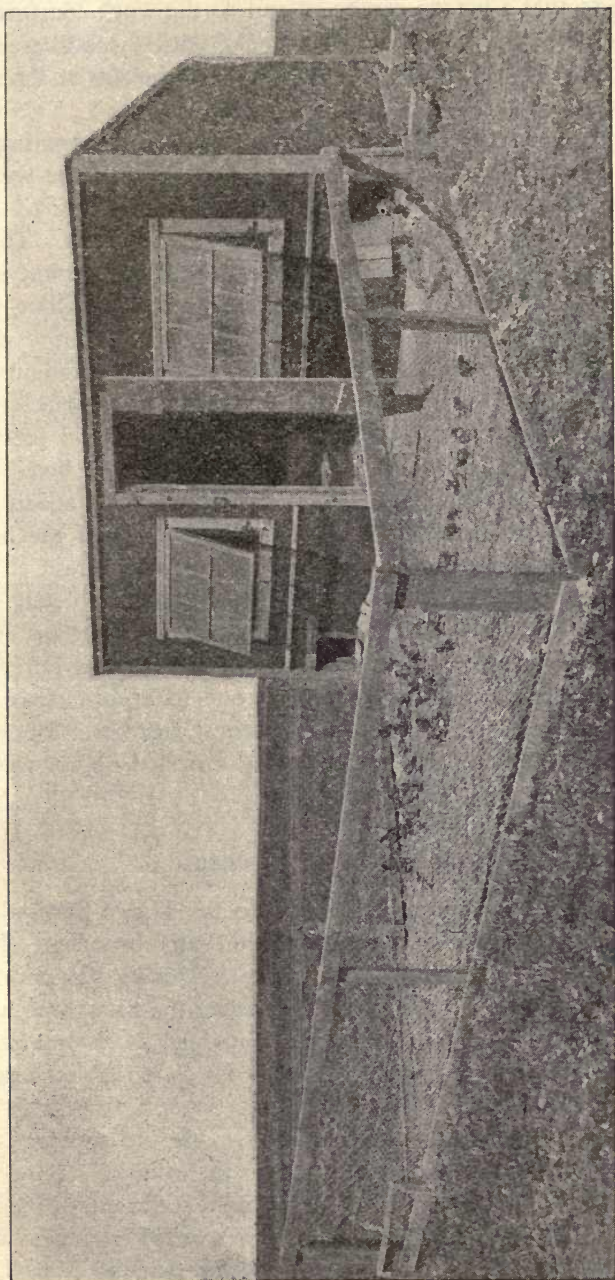


FIG. 2.—Portable brooder house and temporary yard.

enough so that a person can go in and do the work comfortably, and each one accommodates 100 chicks until the cockerels are large enough to be removed. One of these houses is shown in figure 2.

An improvement has recently been made in these brooder houses by providing for better ventilation. When the weather is very hot there is no movement of air within one of these houses, even though the door and windows are open. The air within the house is practically stagnant and, on account of its relatively small volume, becomes intensely hot and stifling when the temperature outside gets high. The effect on the chicks under such circumstances is bad. They retreat to the houses to get shade, but only to be injured if not killed by the hot, stifling air of the house. To remedy this difficulty a slot 2 feet long and 1 foot wide has been cut in the back of each house high up under the eaves. This slot is closed with a wooden slide running in grooves which are put on the outside of the house. The opening is covered on the inside with 2-inch mesh chicken wire. On very hot days the slide is pulled out completely so as to expose the whole opening of the slot. At night or during a period of wet, cold weather the size of the opening is regulated to suit the conditions. It enables one to keep a current of fresh air through the house in the warmest weather. The effect on the well-being of the chicks during a period of hot weather is most marked and satisfactory.

A FRESH AIR BROODER.

For a number of years prior to 1910 the Maine Station used in rearing chickens a commercial, hot air, brooder. These brooders never gave entire satisfaction. During the period in which they were used the mortality during the first three weeks in the brooder was too large, and remained so even after all factors other than the brooder had so far as possible been corrected.

After careful consideration of the matter it appeared that there were three fundamental defects in brooders of the type used. These are: (1) In order to get a sufficiently high temperature underneath the hover in the sort of weather which prevails in this locality during the latter part of March and

first part of April it is necessary to turn the lamp so high that the floor of the brooder gets much too hot. In other words, if brooders of this type are forced at all there is too much "bottom heat." (2) Brooders of this kind have no provision for taking the lamp fumes and vitiated air out of the building in

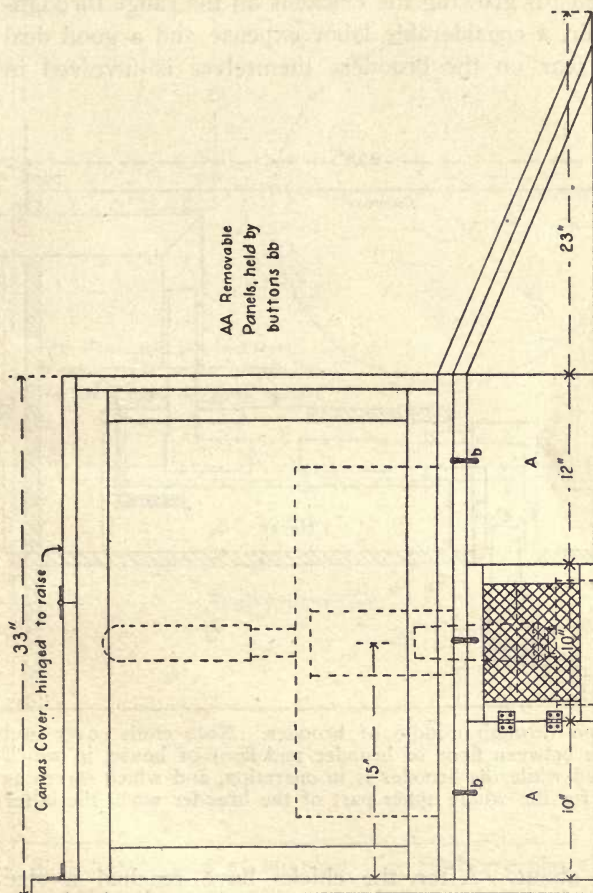


FIG. 3. End elevation of brooder. Note sloping run to floor, hinged cover, removable side panel *AA* on base of brooder. In the center of this is a small door made of 1-4 in. mesh galvanized wire. Through this door the lamp is withdrawn for filling and cleaning. The panel *AA* is removed from the brooder is dismantled, and the whole superstructure is then packed away under the base. See text for further explanation.

which the brooder is operated. This becomes a very serious matter when, as is the case at this Station, two of these brooders are operated in a small colony house, with a floor area of only 6 or 7 feet by 12 feet. In the cold weather of April it is necessary to shut these houses at night in order to maintain

anything like the proper temperature underneath the hovers. When the door of such a house with two of these brooders operating in it is opened in the morning the air is plainly very bad. Not only does it contain all the lamp fumes, but it also has a peculiarly dry, burned-out smell. (3) When these brooders are operated in small colony houses, and the same houses are used for growing the chickens on the range throughout the summer, a considerable labor expense and a good deal of wear and tear on the brooders themselves is involved in

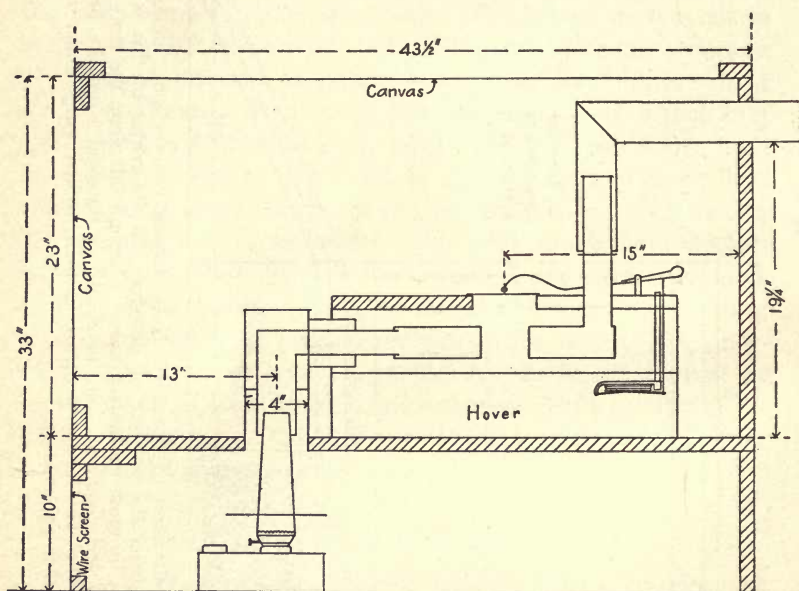


FIG. 4. Section through middle of brooder. Note cloth cover and side, large space between floor of brooder and floor of house, in which the lamp is placed while the brooder is in operation, and which serves as a storage place for the whole upper part of the brooder when the latter is not in use.

moving them about. After the chicks have reached a size when it is no longer necessary for them to have a hover the brooders must be moved out and stored somewhere until the houses are cleaned out in the fall. Then the brooders have to be moved back in again in preparation for the next year's hatching season. All this involves a good deal of labor. Every poultryman knows, or ought to know, that one of the primary

factors in determining financial success or failure in the poultry business is the labor cost. Any plan which attains a real saving of labor, without involving any disadvantages in other ways, is to be welcomed. Certainly the operation of brooders which

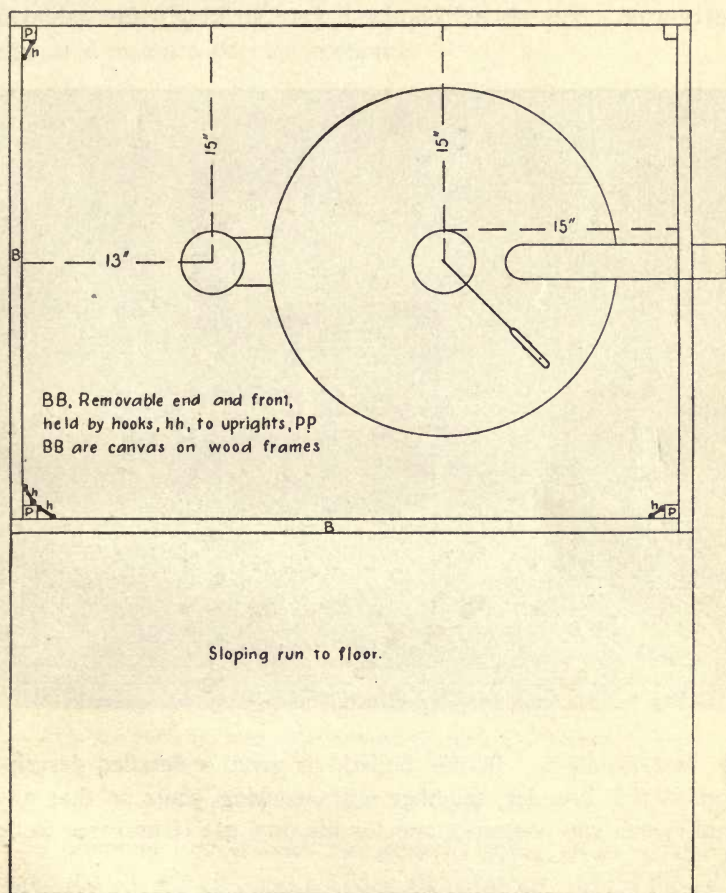


FIG. 5. Floor plan of brooder. For further explanation see text.

have to be handled about so much every season constitutes a labor leak, which on a large plant operating 50 to 100 brooders is considerable in amount.

In view of these considerations it was decided in the hatching season of 1909 to begin some experiments looking toward an improvement in the brooders used for rearing the chickens

at this Station. At first some different types of commercial brooders were tested. The results, however, were not satisfactory. Before the hatching season of 1910 it was decided to try on an experimental scale a brooder devised to overcome the objections mentioned above to brooders of the type formerly used. The results obtained were strikingly favorable to

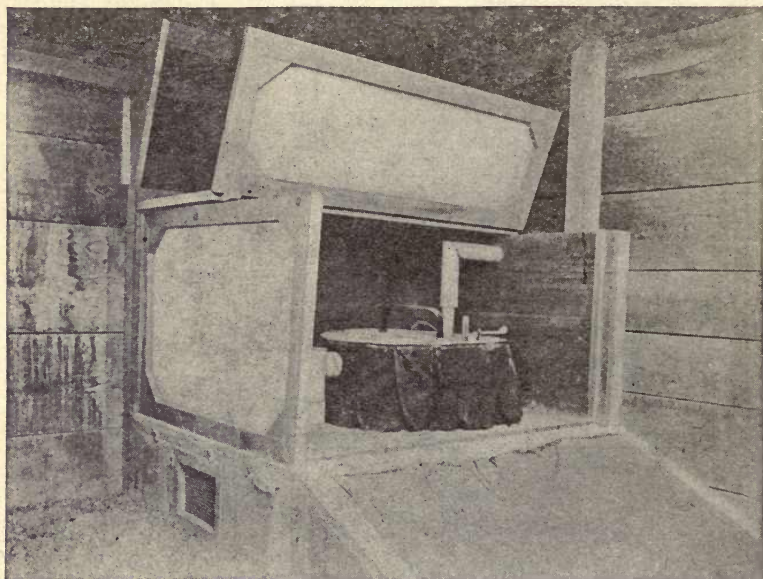


FIG. 6. Showing brooder installed and ready for operation.

the new brooders. In this bulletin is given a detailed description of this brooder, together with working plans so that any poultryman can construct one for his own use if he cares to do so.

The advantages which have been found to accrue from the use of this brooder at the Maine Station fall into two general categories. The first of these is that it is possible to rear in this brooder a larger number of chickens in proportion to the number originally put in than in any other brooder with which the Station has had any experience. That is, the mortality rate of chicks raised in this brooder, is relatively low, particularly as compared with brooders of the old type. Furthermore

not only do the chicks live better in this new brooder but also, according to our experience, those which do live grow better and are thriftier than those raised in the other type of brooder. The second advantage lies in the great saving of labor which is effected by the use of the new brooder. The fact that the brooder never has to be taken away from the house where it is operated means a decided economy.

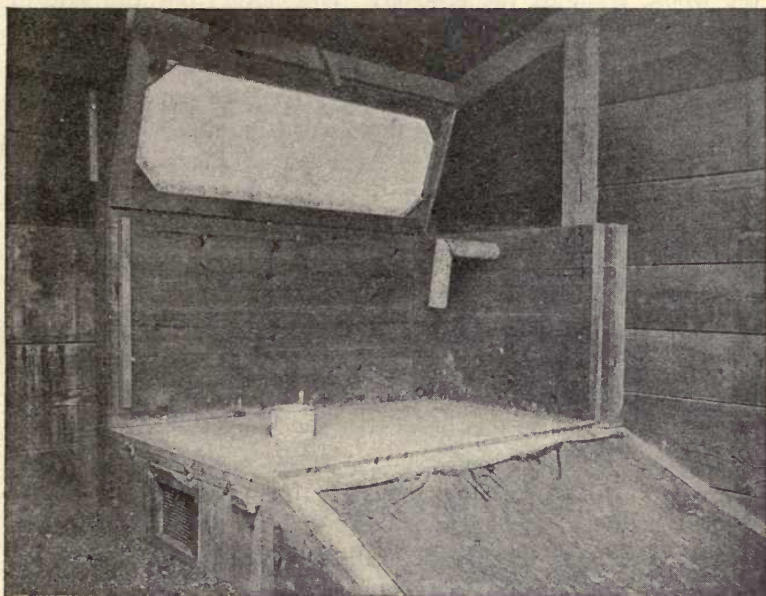


FIG. 7. Showing brooder dismantled and parts stored in base.

CONSTRUCTION OF BROODER.

In planning this brooder the primary point aimed at was to make it a "fresh air" and a "pure air" brooder. With this idea in mind it was thought advisable to make the wall of the brooder in some degree permeable to air. To meet this requirement the walls and cover of the brooder are made of cloth. Essentially the brooder is a cloth box containing a hover, of the type in which the lamp fumes are conducted outside of the building by an exhaust pipe.

These brooders are built as a constituent part of the houses which they occupy. Two brooders are placed in each colony

house, one in each of the back corners of the building. In this way one end wall and the back wall of the building form two of the sides of each brooder. The remaining side and cover are made of cloth tacked on light wooden frames as shown in the working drawings.

The floor of the brooder stands 10 inches above the floor of the house. From the front of the brooder a sloping walk extends down to the house floor, reaching in width clear across the whole front of the brooder. The cloth front and side of the brooder are not permanently fixed in position but are removable panels, which are held together and to the frame work by hooks and eyes (see fig. 5). The cover is hinged in the middle in such a way that it can be either half opened or entirely opened and folded back out of the way. In consequence of this arrangement it is possible to regulate with great nicety the amount of air which shall be admitted to the brooder. Either the front or the side panel may be tilted out as much as desired at the base thus admitting air there. Furthermore by partly opening a panel and the cover it is possible to insure that there shall be a circulation of air through the brooder at all times.

The hover used in this brooder is the Universal Hover, made by the Prairie State Incubator Co., Homer City, Pa. It is, however, modified in certain particulars for present use. In the first place the arrangement is such that the lamp is inside the house underneath the brooder rather than in a box outside the house, as in the usual arrangement of this hover. The lamp in this brooder is in the house directly under the hover. The reason for this modification is that in this climate, where one is likely to have bad weather during the early part of the hatching and rearing season, with heavy winds, snow, and rain, it is much easier and more satisfactory to take care of the lamp inside the house than from a small box outside the house. Another modification is that in the hovers which are installed in these brooders an especially heavy insulation is put on top of the drum to reduce the loss of heat by radiation in extremely cold weather early in the spring.

One of the essential points about the brooder is its compactness in storage, and the fact that all the parts may be stored in the base of the brooder itself. In this way the labor expense

of carrying back and forth parts from a storage house each year is avoided. To bring about this result the size of the base is so calculated that all the parts of the brooder may be enclosed in it. The way in which this is done is apparent from an examination of fig. 3. It will be seen that the end of the brooder base, (marked *AA* in the diagram) is removable, being held in place by buttons *bb*. When the end of the brooding season is reached and there is no further use for the brooder that year, the side and front end panel of the brooder are removed, the canvas cover folded back and tacked to the wall of the building and the hover dismantled. All of the parts are then shoved under the brooder floor and the panel *AA* put back in place again. The floor of the brooder is removable so that it, and the floor underneath, may be cleaned and disinfected. By removing its legs the hover may be stored in the brooder base along with the other parts, or if one does not desire to do this the hover may be suspended close up to the roof of the building. In that position it will be impossible for the birds to roost on it. Of course, all movable parts should be taken from the hover before it is hung up in this way. These parts may be stored in the brooder base. After the chickens are out of the house in the fall the parts of the brooder are taken out, thoroughly cleaned and disinfected, and then the whole is reassembled and made ready for the hatching season of the next year.

Detailed working drawings of the brooder are given herewith. Fig. 3 shows the end elevation of the brooder; fig. 4 shows a section through the middle of the brooder; fig. 5 shows a floor plan; fig. 6 shows the brooder in operation; and fig. 7 shows its appearance when dismantled and with the parts stored in the base, while the large chickens are using the house. All dimensions are given on these drawings and from them it should be possible for anyone to construct the brooder for himself.

As material any sort of planed lumber may be used. Probably pine will be found satisfactory and economical in most cases. Spruce or hemlock may be used to build the base, if one desires. For the cover and removable sides almost any sort of cloth may be used. Here we have employed the lightest

weight canvas (duck) that could be obtained locally. Burlap may be used, or even unbleached cotton cloth in localities where the outside temperature is not too low.

TREATMENT OF YOUNG CHICKS.

In the work of the Maine Station all of the birds are hatched in incubators, and in pedigree wire baskets* since all are pedigreed. They are not disturbed on the 21st day of incubation, but on the morning of the 22nd day the chicks are removed from the baskets and leg-banded. Each chick is then returned to the basket from which it came and put back in the incubator. There they are left until they are from 48 to 72 hours old. The reason for keeping the chicks isolated in this way for so long a time is to prevent their eating each others droppings. It has been shown by Rettger and Stoneburn† that one of the most important chick scourges, bacillary white diarrhea, is (a) transmitted through the egg, and (b) can only infect non-infected birds during the first 48 hours of their life.

After this time the chicks are carried in warm covered baskets to the brooders, and 50 or 60 are put under each hover, where the temperature is between 95° and 100° F. The temperature is not allowed to fall below 95° F. during the first week, or 90° F. during the second week; then it is gradually reduced according to the temperature outside, care being taken not to drive the chicks out by too much heat, or cause them to crowd together under the hover because they are cold. They should flatten out separately when young, and a little later lie with their heads just at the edge of the fringe of the hover. They should never be allowed to huddle outside of the brooder. They huddle because they are cold, and they should be put under the hover to get warm, until they learn to go there of their own accord. Neither should they be allowed to stay under the hover too much, but in the daytime should be forced out into the cooler air where they gain strength. They ought not to be allowed to get more than a foot from the hover during the first two days; then a little farther away each day, and down on the house floor about the fourth or fifth day, if the

* See Bulletin 159, Maine Agricultural Experiment Station.

† Storrs Agr. Expt. Stat. Bulletin 60.

weather is not too cold. They must not get cold enough to huddle or cry, but must come out from under the hover frequently.

The floor of the brooder is cleaned every day and kept well sprinkled with alfalfa meal. So far as we are aware sand may be used for this purpose, but it has never been tried at this Station. The floor of the house is covered with clover leaves or with hay chaff from the feeding floor in the cattle barns.

FEEDS AND FEEDING.

FEEDING YOUNG CHICKENS.

The best method of feeding young chicks is at present a matter of some uncertainty, and it is doubtful if there ever will be general agreement as to the one best method. One condition, however, appears to be imperative, and that is that the young things be not allowed to overeat. A number of different methods of feeding young chickens have been used at the Station in the past. The most useful of these methods follow.

Method 1.—Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about six times their bulk of rolled oats, by rubbing both together. This mixture is the feed for two or three days, until the chicks have learned how to eat. It is fed with chick grit, on the brooder floor, on the short cut clover or chaff.

About the third day the chicks are fed a mixture of hard, fine-broken grains, as soon as they can see to eat in the morning. The mixture now used has the following composition:

Parts by weight.

Cracked wheat	15
Pinhead oats (granulated oat meal)	10
Fine screened cracked corn	15
Fine cracked peas	3
Broken rice	2
Chick grit	5
Fine charcoal (chick size)	2

It is fed on the litter, care being taken to limit the quantity, so they shall be hungry at 9 o'clock a. m.

Several of the prepared, dry, commercial chick feeds may be substituted for the broken grains. They are satisfactory when made of good, clean, broken grains and seeds, but they contain no secret properties that make them more desirable than the home-mixed broken grains mentioned above. Their use is simply a matter of convenience. When only a few chicks are raised, it is generally more convenient, and probably not more expensive, to buy the prepared feed, but when many are raised it is less expensive to use the home-mixed feeds.

Sharp grit, fine charcoal, and clean water are always before the chicks. At 9 o'clock the rolled oats and egg mixture is fed in tin plates with low rims. After they have had the feed before them five minutes the dishes are removed and they have nothing to lunch on. At 12.30 o'clock the hard-grain mixture is fed again, as in the morning, and at 4.30 or 5 o'clock they are fed all they will eat in half an hour of the rolled oats and egg mixture.

When they are about 3 weeks old the rolled oats and egg mixture is gradually displaced by a mixture having the following composition:

	Parts by weight.
Wheat bran (clean)	2
Corn meal	4
"Daisy flour" (or other low grade flour)	2
Linseed meal	1
Screened beef scrap	2

This mixture is moistened with water just enough so that it is not sticky, but will crumble when a handful is squeezed and then released. The birds are developed far enough by this time so that the tin plates are discarded for light troughs with low sides. Young chicks like the moist mash better than that not moistened, and will eat more of it in a short time. There is no danger from the free use of the properly made mash twice a day, and since it is already ground the young birds can eat and digest more of it than when the feed is all coarse. This is a very important fact, and should be taken advantage of at the time when the young chicks are most susceptible to rapid growth, but the development must be moderate during the first few weeks. The digestive organs must be kept in normal condi-

tion by the partial use of hard feed, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

By the time the chicks are 5 or 6 weeks old the small broken grains are discontinued and the two litter feeds are wholly of screened cracked corn and whole wheat. Only good clean wheat that is not sour or musty should be used.

When young chicks are fed as described, the results have always been satisfactory if the chicks have not been given too much of the scratch feed and if the dishes of ground material have been removed immediately after the meal was completed. The objections to this system of feeding are the extra labor involved in preparing the eggs, mixing the feed with water, and removing the troughs at the proper time.

Method 2.—This is like Method 1, except that fine beef scrap is used instead of boiled eggs and the mash is not moistened.

Early in the morning the chicks are given the hard feed on the floor litter as described in Method 1. At 9 o'clock they are fed a mixture having the following composition:

	Parts by weight.
Rolled oats	2
Wheat bran	2
Corn meal	2
Linseed meal	$\frac{1}{2}$
Screened beef scrap	1

This is given in the plates or troughs, and the dishes are removed after ten minutes' use.

At 12.30 the hard grains are fed again, and at 4.30 or 5 the dry-meal mixture is given to them for half an hour or left until their bedtime. The meal being dry, the chicks can not eat it as readily as they can the egg and rolled oats or the moistened mash. For that reason it is left for them to feed upon longer than when moistened with the egg and water, but is never left before them more than ten minutes at the 9-o'clock feeding time. The aim is to give them enough at each of the four meals so that their desire for food may be satisfied at the time, but to make sure that they have nothing left to lunch upon. It is desired to have their crops empty of feed before feeding them again. When treated in this way they will have sharp

appetites when the feeder appears, and come racing out from the brooder to meet him. If they have been overfed at the previous meal, and have lunched when they saw fit, they do not care for the feeder's coming. If overfed a few times the creatures become debilitated and worthless.

What has been said so far is with reference to chicks that are hatched out in early spring, at a season of the year when it is impossible under the climatic conditions in Maine for them to get out of doors for work.

Method 3.—This is like Method 2, except that the first mash for the young chicks has the following composition:

Parts by weight.	
Wheat bran	4
Corn meal	3½
Linseed meal	½
Screened beef scrap	2
Alfalfa meal	1

This mixture is scalded and then dry rolled oats are mixed with it in the proportion of 2 parts rolled oats to 6 parts of the mixture. The reason for mixing in this way is that it has been found by experience that if rolled oats are mixed with the other materials of the mash before scalding there is a tendency for the mash to be soggy after it is wet. Mixing in the way here outlined has been found to improve the mash greatly.

This mash and the dry grains are fed as in Method 2 until the chicks are about 3 weeks old. From 3 weeks on to 6 or 8 weeks the composition of the mash is as follows:

Parts by weight.	
Wheat bran	2
Corn meal	3
Linseed meal	½
Daisy flour (or other low-grade flour)	1
Beef scrap	1

Method 4.—When warm weather comes and the later-hatched chicks are able to get out on the ground they find much to amuse them, and they work hard and are able to eat and digest more feed. Under these conditions the dry-meal mixture described in Method 2 is kept constantly before them in troughs, with good results. With two feeds a day of the broken grains in the litter

they have hard feed enough to insure health and they can safely peck away at the dry-meal mixture—a mouthful or two at a time—when they seem to happen to think of it, and thrive. This method has been considerably used in feeding April and May hatched chicks. Many times the results from it have been good. At other times, when the weather was dark and raw out of doors and the little things were held inside, they would hang around the troughs and overeat. They would grow rapidly for a few days, then commence to go lame, eat little, and seek the warm hover never to recover.

Method 5.—This consists in feeding the cracked corn, cracked wheat, pin-head oats, and millet seed in the litter four times a day, and keeping a trough of fine beef scrap within reach all the time. Sometimes commercial chick feeds have been used instead of the cracked corn, wheat, oats, and millet. By this system the losses of birds have been small when the feeding has not been so liberal as to clog the appetite. Much care is necessary in adjusting the quantity of feed to the needs of the birds.

Other methods of feeding young chicks have been tried and the results watched. Method 1 has been used for several years and no other has been found that gives better growth or less losses of birds. The only objection to it is the labor required in preparing the feed. In the work of the Station Method 3 is now preferred and used. The losses of chicks are small by either of the methods. The labor in Method 2 is considerably less than is required in Method 1. Where either Methods 1, 2, or 3 are used the liability of injury to the chicks is much less than when Methods 4 or 5 are followed.

There are no mysteries connected with the raising of the young chickens. Every chick that is well hatched out by the twenty-first day of incubation should live, and will do so as a rule if kept dry, at reasonable temperatures, and not allowed to overeat.

The most careful work of the poultryman during the whole year is required in getting the chicks through the first three weeks of their lives successfully. If they are vigorous up to the fourth week, there is little liability of injuring them thereafter by any system of feeding, if it is only generous enough and they have their liberty.

FEEDING CHICKS ON THE RANGE.

By the middle of June the chickens that were hatched in April are being fed on cracked corn, wheat, and the mash. At about that time the portable houses containing the chickens are drawn from their winter locations out to an open hayfield where the crop has been harvested and the grass is short and green. If not too much worn, the same field may be used a second season for chickens, but this is not recommended. A new, clean piece of turf land should be used each year. At least two acres should be allowed for each 1000 chickens, if the land can be had. It is possible, as has been demonstrated repeatedly, to grow good sound vigorous stock on smaller areas. But to do this is much more difficult and trying work than with larger areas.

When the chickens are moved to the range, the sexes are separated. The methods of feeding the cockerels and pullets differ, and there has been a gradual change in the methods of feeding. Each method has given good results. The changes have been introduced to save labor. After the chickens were moved to the range they were fed in the morning and evening with a moistened mixture of corn meal, middlings, and wheat bran, to which one-tenth as much beef scrap was added. The other two feeds were of wheat and cracked corn.

In 1904 a change was made in the manner of feeding 1,400 female chickens by omitting the moist mash and keeping in separate slatted troughs cracked corn, wheat, beef scrap, cracked bone, oyster shell, and grit where they could help themselves whenever they desired to do so. Grit, bone, oyster shell, and clean water were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

In 1905 another trough containing a dry mash consisting of 1 part wheat bran, 2 parts corn meal, 1 part middlings, and 1 part beef scrap was used in addition to those containing the grains. The results were satisfactory. The labor of feeding was far less than that required by any other method tried. The birds did not hang around the troughs and overeat, but helped themselves, a little at a time, and ranged off, hunting or playing, and coming back again to the food supply at the troughs when so inclined. There was no rushing or crowding about the at-

tendant, as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap, they did not overeat of it. During the range season, from June to the close of October, the birds ate just about 1 pound of the scrap to 10 pounds of the cracked corn and wheat. This is practically the proportion eaten when the moist mash was used.

THE FEEDING TROUGH.

The difficulty of keeping the feed clean and dry during continued exposure is nearly overcome by using troughs with

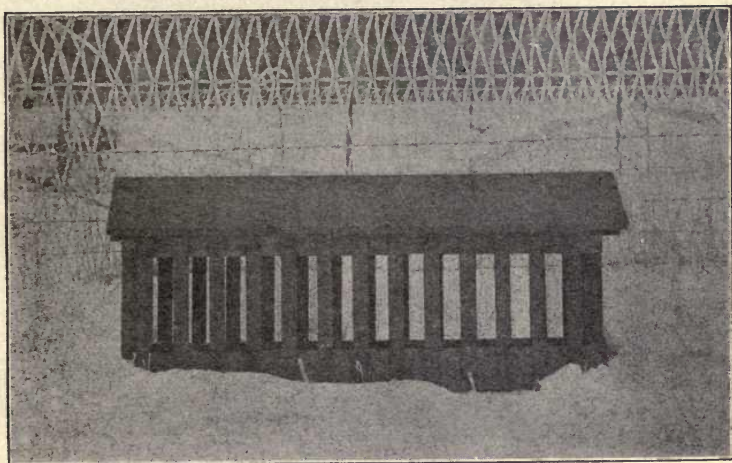


FIG. 8. Chicken feeding trough, accessible from both sides, with cover on.

slatted sides and broad, detachable roofs (figs. 8 and 9). The troughs which were formerly in use at the station were from 6 to 10 feet long, with the sides 5 inches high. The lath slats are 2 inches apart, and the troughs are 16 inches high from floor to roof. The roofs project about 2 inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests, as shown in figure 9. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is economical of feed, keeping it in good condition and avoiding waste. When dry mash is used there may be considerable waste by the

finer parts being blown away, and on this account the dry-mash should be put in a sheltered place out of the reach of wind.

AN IMPROVED RANGE FEED TROUGH.

The type of slatted feed trough described above is open to certain objections. It is very difficult to keep the grain dry in it in wet stormy weather. Furthermore, the fact that very small chickens cannot use this type of trough entails additional labor. There must be flat boards with narrow rims for the very young chickens in addition to the range troughs for the older

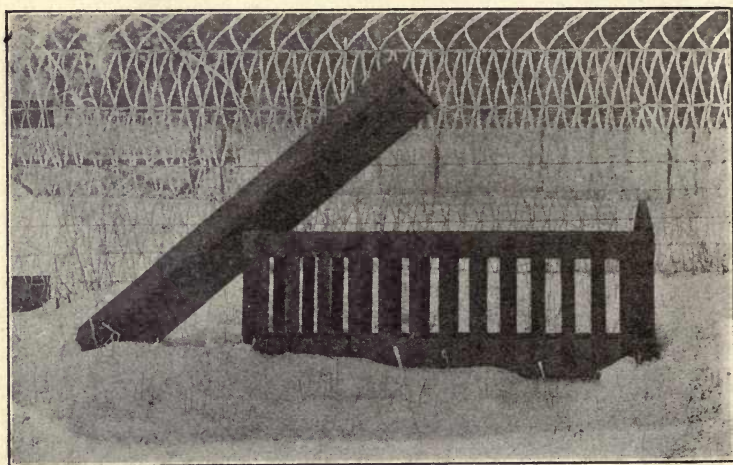


FIG. 9. Chicken feeding trough with cover removed.

chicks. An improved range trough obviates both of these disadvantages and has other points to recommend it. The essential features of this trough are shown in Figs. 10 to 12. The improvements consist, first, in making the slatted front of the trough removable as a whole, leaving then a flat board bottom with a rail in front of it an inch high to hold the grain in place. With the slat front removed the trough duplicates the conditions of the flat chick feeding board, used by many poultry keepers for feeding chicks during the first two or three weeks of life. As the chicks grow older this slatted front can be put on the trough and held in place with the hooks and eyes shown in the photograph.

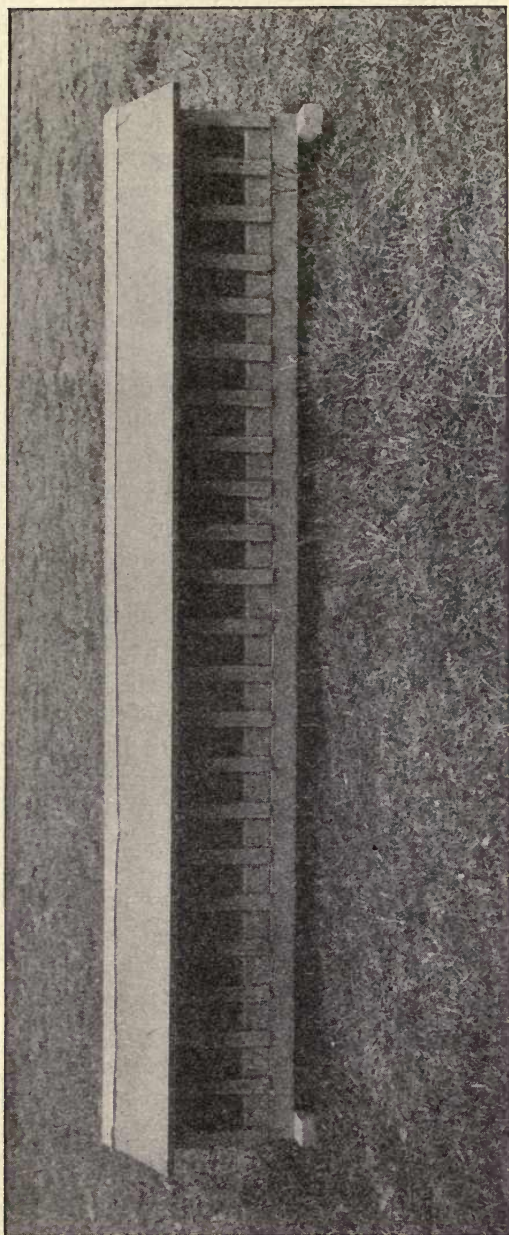


FIG. 10. Front view of feed trough, with slats in place. For large chickens.

A second improvement consists in hinging the top rather than making it in one piece and removing as a whole, as was the case with the older feed troughs at this Station. It will be noted that this feed trough is open to the birds only from one side. The reason for this arrangement is that it is designed to place the feed troughs in holes cut in the longitudinal fences in the range yards, with the back part of the trough and the hinged cover extending into a long walk running the whole length of the range behind the yards. In this way the troughs can be filled from the outside without the necessity of going into the yard, opening gates, etc., thus reducing the labor cost of operation considerably.

Of course it is entirely possible to make troughs in accordance with the principle of this improvement, with removable slatted openings on both sides, to be set down in the middle of the yards so that the birds can get at the feed from both directions.

The dimensions of the troughs as used here are those given in the following table. It is, of course, not essential that these

dimensions be absolutely followed in building feed troughs according to this principle, particularly the length dimensions. The dimensions of the boards forming the roof, however, and their angle, are of more or less importance since actual trial has shown that when built as here pictured and described the grain will keep dry in the trough even in driving showers or storms. A strip of canvas keeps the hinged joint of the roof dry.

Dimensions of Improved Feed Trough.

Length	8 ft. 4 inches
Height to peak.....	1 " 6 "
Width at bottom.....	3 "
Width at widest point.....	9½ "
Height of front opening.....	12½ "
Width of roof boards (front and back same)...	11 "

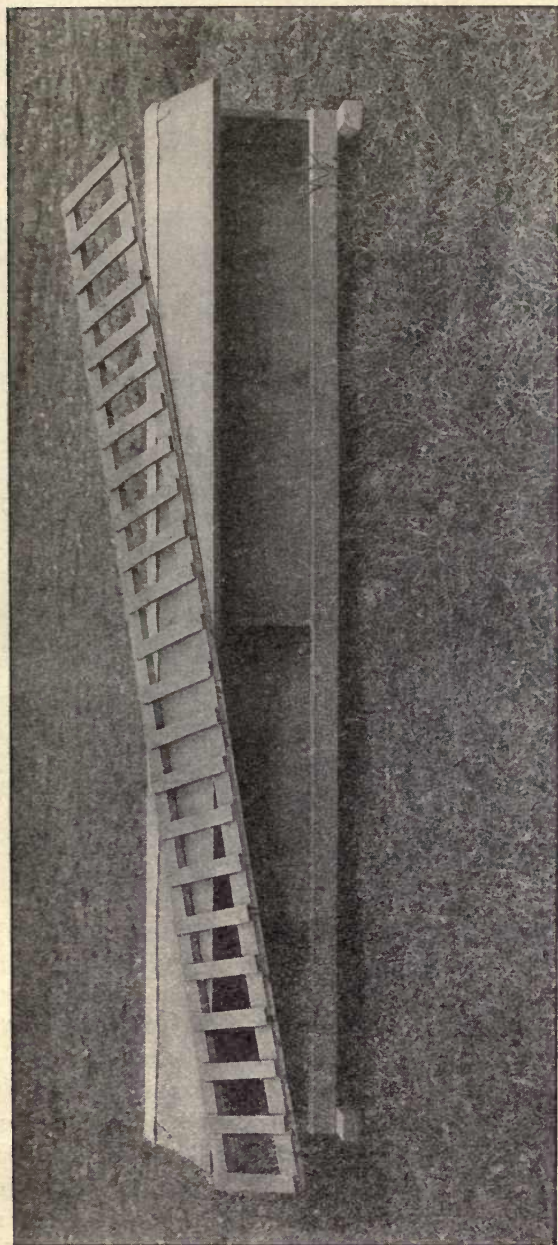


FIG. 11. Front view of feed trough with slats removed and laid across top. This trough is now in condition for the use of very small chicks.

FEEDING THE COCKERELS FOR MARKET.

At the Maine Station many of the cockerels are to be used for breeding purposes, and they are fed in flocks of about 100 on the range in about the same way as the pullets. The dry-feed method is now used for them as satisfactorily as for the pullets.

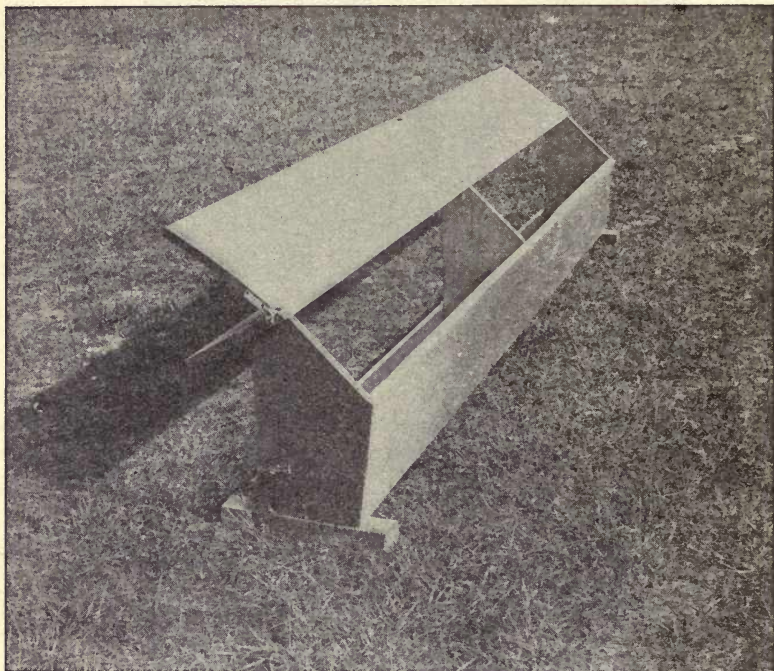


FIG. 12. End and top view of trough with cover open and slatted front removed. Note hook which holds front in place.

A very large proportion of the cockerels raised in New England are sent to the market alive, without being fattened. Quite extended experiments at the Maine Station with many birds in different years indicate very clearly that keeping the cockerels for a few weeks with special feeding will add materially to the selling price. Not infrequently this will make the difference between loss from the low price obtained for slow-selling unfattened birds and the profit from comparatively quick-selling

specially fed birds at a much higher price. The higher price is due partly to the increased weight and partly to the superior quality of the well-covered soft-fleshed chickens. As the bulletins containing the results of these feeding experiments with cockerels are out of print, the following brief summary of the results obtained is given:

The number of pounds of grain required to produce 1 pound of gain in fattening cockerels was ascertained in experiments comparing (1) the effect of housing, (2) the effect of age, and (3) the effect of skim milk. The grain mixture used in these series of experiments was the same, consisting of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of meat meal. This was fed as a porridge thick enough to drop but not to run from a spoon.

The French and English fatteners who make a specialty of the business, fattening thousands of chickens each year, confine the chickens in small coops. The coops used at the Maine Station gave a floor space of 16 by 23 inches, in each of which 4 chickens were placed. The coops were constructed of laths with closed-end partitions of boards. The floors, sides, and tops were of laths placed three-quarters of an inch apart. By simply moving the pens thus constructed the floors were kept clean. V-shaped troughs with 3-inch sides were placed in front and about 2 inches above the level of the floors of the coops. Cockerels thus fed were compared with others kept in small houses 9 by 11 feet in size, with an attached yard 20 feet square. The yard was entirely free from anything that would serve as green feed. Twenty birds were put in each of these houses. As a result of experiments with fattening 286 birds it was found that on the average 7.9 pounds of grain were required to produce 1 pound of gain in the case of birds fed in the coops, and 5.9 pounds in the case of those fed in the small houses and yards.

An experiment with 150 birds when they were 4 months old showed that they required 4.9 pounds of grain to produce 1 pound of gain, while birds from the same stock, when they were 6 months old, required 7.4 pounds of grain to produce 1 pound of gain.

An experiment with 68 birds showed that when the porridge was wet with skim milk only 4.3 pounds of grain were required to produce 1 pound of gain, against 5.3 pounds when the porridge was wet with water. Eight pounds of skim milk was used with each pound of grain.

These experiments warrant the following conclusions: (1) As great gains are made just as cheaply and more easily when the chickens are put into small houses and yards as when they are fed in small lots in lattice coops just large enough to hold them. (2) Four weeks is about the limit of profitable feeding, both individually and in flocks. (3) Chickens gain faster while young. Birds that are from 150 to 175 days old have uniformly given comparatively small gains. (4) The practice of successful poultrymen selling chickens at the earliest marketable age is well founded. The spring chicken sold at Thanksgiving time is an expensive product.

The experiments clearly indicate that it is profitable to fatten chickens in cheaply constructed sheds or in large coops with small runs for about four weeks and then send them to market dressed. In quality the well-covered, soft-fleshed chickens are so much superior to the same birds not specially prepared that the former will be sought for at a higher price. The dairy farmer is particularly well prepared to carry on this work, as he has the skim milk which these experiments show to be of so great importance in obtaining cheap rapid growth and superior quality of flesh.

FEEDING THE LAYING PULLETS.

The feed of all adult birds, whether pullets or not, consists of two essential parts: (a) the whole or cracked grains scattered in the litter, and (b) the mixture of dry ground grains which has come to be generally known as a dry mash. These two component parts of the ration and the methods of feeding them will be considered separately. In addition to the grains and dry mash, oyster shell, dry cracked bone, grit, and charcoal are kept in slatted troughs, and are accessible at all times. Plenty of clean water is furnished. About 5 pounds of clover

hay cut into 1-2-inch lengths is fed daily to each 100 birds in the breeding pens during the breeding season. When the wheat, oats, and cracked corn are given, the birds are always ready and anxious for them, and they scratch in the litter for the very last kernel before going to the trough where an abundance of feed is in store.

It is very evident that the hens like the broken and whole grains better than the mixture of the fine, dry materials; yet they by no means dislike the latter, for they help themselves to it, a mouthful or two at a time, whenever they seem to need it, and never go to bed with empty crops, so far as noted. They apparently do not like it well enough to gorge themselves with it, and sit down, loaf, get overfat, and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mash in troughs.

Some of the advantages of this method of feeding are that the mash is put in the hoppers at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing that always occurs at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is common when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

Taking first the dry grains, the following may be said in regard to the method in which they are fed: Early in the morning for each 100 hens 4 quarts of whole or cracked corn is scattered on the litter, which is 6 to 8 inches deep on the floor. This is not mixed into the litter, for the straw is dry and light, and enough of the grain is hidden so the birds commence scratching for it almost immediately. At 10 o'clock they are fed in the same way 2 quarts of wheat and 2 quarts of oats. This is all of the regular feeding that is done.

When corn is used freely and made a prominent factor in the ration it has been thought best to have the kernels broken, so that in hunting and scratching for the small pieces the birds might get the exercise needed to keep themselves in health and

vigor. It was reasoned that even a small quantity of whole corn could be readily seen and picked up from the straw litter with little exertion, and that the vices of luxury and idleness would follow. In order to test this view an experiment was carried out at the Station in the winter of 1906-7 in which whole corn was substituted for cracked corn in the ration of 500 laying pullets. A control lot of 500 received cracked corn. All other conditions affecting the two lots were kept as nearly identical as possible. The result of the experiment was that there was no appreciable difference in regard to either egg production, health, or general well-being between the two flocks of birds.

The litter which the Station now uses for its houses in preference to all others which have been tried, consists of a mixture of dry pine shavings and straw. The shavings can be obtained in this part of the country from box mills in bales, which are sold at a price of from 5 to 10 cents per bale. These shavings are spread on the floor of the pen to a depth of some 5 to 7 inches. From 6 to 8 bales will cover the floor of a pen which accommodates from 100 to 125 birds. On top of these shavings is spread a thin layer of straw. Straw which has not been baled is preferred because it is less liable to be broken and will consequently wear longer in the pen. This combination of straw and shavings gives excellent satisfaction as a litter. The straw serves the purpose of protecting the shavings so that they last a longer time than would otherwise be the case before they are finally worked up into a mass of fine material which packs down and becomes damp. The shavings became damp much less quickly than does a litter of straw alone. This is because they are finer, and the birds can keep them worked over much more thoroughly. This constantly exposes and dries out new portions of the mass of litter. Using this combination of shavings and straw it is not usually found necessary to change the litter in the pens oftener than once in three months.

It is in regard to the dry mash portion of the ration in which the changes already referred to have been made. The dry mash which was *formerly used* at the Station had the following composition:

	Pounds.
Wheat bran	200
Corn meal	100
Daisy flour (or other low-grade flour)	100
Gluten meal or brewers' grains	100
Linseed meal	100
Beef scrap	100

The experience of the Station with this mash extending as it has over a number of years has indicated that it was somewhat too rich. The relatively large amount of such concentrated feeds as linseed meal and gluten meal seemed to make too rich a ration for the well-being of the fowls. During the years when this mash was fed more or less difficulty was always experienced with liver troubles in the birds. Birds died with all the symptoms that would be expected to come from indigestion arising from feeding too rich food.

In planning the new dry mash ration consideration was given to the physiological conditions under which the birds developed and under which they were placed in the laying houses. It is evident that the bringing of the birds in from the range upon which they have grown from little chickens, into the laying houses, is apt to be a very violent and abrupt transition. It has seemed in studying the birds in the fall of the year that this change was an important time in the life of the bird, and that the results during the subsequent winter with reference to egg production depended much upon the way the transition from range conditions to the laying house was made. It seemed advisable both on general grounds and from observation of the birds themselves to make this change as gradual as possible. With this idea in mind the pullets have been brought into the houses from the range much earlier during the past few years than was the custom before. It is the custom at the present time to bring in the pullets from the range as soon as possible after the first of September.

When the pullets are brought in as early as this it is not, of course, advisable to shut them up entirely in the houses at once. On the contrary, the work is planned in such a way that there is always a freshly seeded yard full of green grass for the birds to run in after they are brought into the house until cold

weather sets in in the fall. In other words, the birds are brought from free range into a condition of restricted range, but with better pasturage on the restricted than on free range. The yards are freshly seeded and have not been trampled down or burned and dried out by the sun, as is the grass on the open range from which the birds are taken. In this way the attempt is made to have the transition from open range conditions to house conditions as gradual as possible. After about two months, or occasionally even a little longer of restricted range, the birds are finally shut up in the curtain front house for the winter season.

Further in accordance with this idea of gradual change it is thought wise not to put the pullets which are brought in from the free range conditions abruptly on to the heavy, forced-laying mash which it seems to be necessary for them to have during the winter months if they are to do their best in the way of egg production. It has been said that a hen will not lay her best unless she is on full feeding. This is quite true, but it is probably equally true that a great deal of harm can be done to a pullet in regard to her future egg production by abruptly bringing her from free range conditions into restricted yards or to entire confinement in the house and putting her on a heavy, rich laying mash like the one which was formerly fed at this Station. On the contrary, it seems reasonable to bring the birds more gradually on to this rich ration. It is in accordance with this idea that the dry mash feed which is now used at the Station has been planned. The formulas and method of feeding this new dry mash are given below. It will be noted that the mash is made richer in successive months. These formulas are planned on the assumption that the pullets will be brought into the winter laying quarters sometime during the month of September.

Composition of Dry Mash Fed to Laying Pullets.

First month in laying house (September) :—

Bran	300 lbs.
Corn meal	100 lbs.
Daisy flour (or other low-grade flour)	100 lbs.
Meat scrap	100 lbs.

Second month in laying house (October) :—

Bran	200 lbs.
Corn meal	100 lbs.
Daisy flour, or other low-grade flour	100 lbs.
Gluten meal	100 lbs.
Meat scrap	100 lbs.

Third month in the laying house (November) :—

The mash has the same composition as that of the second month given above *with the addition of 50 pounds of linseed meal.*

Fourth month in the laying house :—

The mash has the same composition as that of the second month given above.

Fifth month in the laying house :—

The mash has the same composition as that of the third month as given above.

From this time on 50 pounds of linseed meal are put into the mash as given for the second month above every alternate month. That is to say, one month linseed meal is fed and the next month it is not.

This dry mash made as described above is kept before the birds all the time in open hoppers of the type described farther on.

The advantages which it is believed have resulted from this method of feeding the laying pullets are two fold: first, in the good effect on the vitality of the birds, and, second, in its effect on the evenness of egg production during the winter months. It is a fact well known to poultrymen that if pullets are too rapidly forced for egg production in the early fall there is a marked tendency for them to moult during the winter at just the time when they should be doing their best work in egg production. Since adopting the method of feeding the pullets de-

scribed above, not only have the birds been much freer of digestive troubles and diseases involving the liver, but also there has been no moulting in the early winter after a short spurt of egg production in the fall months. On the contrary the egg production on this plan begins in September and October and gradually and steadily increases through the winter months. During the past two years while this method of feeding has been used, there has been hardly a pullet in winter moult, whereas on the old system of feeding such birds were common every year.

FEEDING THE HENS, COCKERELS AND COCKS KEPT OVER THE WINTER FOR BREEDING PURPOSES.

Observations made in connection with the work of this Station, as well as a study of the literature which exists upon the subject, have led to the opinion that in order to get the best results in respect to the fertility and hatching quality of eggs it is not desirable to feed birds which are to be used as breeders the heavy laying ration which is used to force egg production during the winter months in pullets. The feeding of such rich food has a tendency, it is believed, to reduce or impair the fertility and hatching quality of the eggs. Therefore, a plan of feeding birds kept to be used as breeders has been devised with the idea of getting over this difficulty so far as possible. This method of feeding is used for old hens, cockerels and cock birds which are kept from one season to another for breeding. The aim is to keep these birds on as light a ration as is consistent with the maintenance of good condition until just before the beginning of the breeding season when they are to be used and then to put them on a more stimulating and richer ration. The scratch food given to this breeding stock is the same as that given to the pullets, namely, corn for the first morning feed and a mixture of wheat and oats for the second feed of the day, both scattered in the litter. If, however, there is any tendency for the yearling hens kept as breeders to get unduly fat during the winter corn is not fed as a litter grain. The hens, under such circumstances, are simply given the mixture of wheat and oats at both feedings.

The dry mash used for these birds kept as breeders has the following composition:—

Bran	400 lbs.
Corn meal	50 lbs.
Daisy flour, or other low-grade flour	50 lbs.
Meat scrap	100 lbs.

Birds kept over from one season to another are managed in the following way. The birds completing their pullet year which are to be kept as breeders are continued on the usual pullet ration until after they have finished their moult in the early fall, usually in September or early October with the birds here. Immediately after the moult is over and the hens are well feathered out they are put on the dry mash ration given above. They are fed in the way described until the beginning of their second breeding season. At this Station the breeding pens are usually mated up about the first of February. During the breeding season all birds, both hens and pullets are fed the following mash:

Wheat bran	200 lbs.
Corn meal	100 lbs.
Daisy flour	100 lbs.
Meat scrap	50 lbs.
Dry bone meal	50 lbs.

The experience of the Station indicates that by reducing animal food to a minimum it is possible to improve markedly the hatching qualities of the eggs. Besides the dry mash the breeders are fed wheat, corn and oats in the same way as the laying pullets. Further they are given an abundance of green food, always including green sprouted oats.

GREEN FOOD FOR POULTRY.

During recent years an increasing amount of attention has been paid by poultrymen everywhere to the furnishing of green food to their fowls during the winter months, when it is impossible, in northern parts of the country, at least, for the birds to get fresh succulent pasturage out of doors. General experience seems to teach that an addition of green succulent food to the ration of laying hens tends to keep them in better physical condition and helps towards a better egg production. On the

poultry plant of the Maine Station considerable attention has been given to this matter of supplying green and succulent food and as a result of experience extending now over a number of years, a satisfactory scheme of furnishing this necessary part of the ration under our conditions has been worked out.

To be satisfactory not only must the green food given to poultry be of the proper kind to give good results in egg production, but also it must be something which can be produced and handled at small cost. Furthermore a factor which is frequently lost sight of is that fowls need something besides succulence in their so-called "green" food. There is a distinction between a succulent fodder and a "green food" in the strict sense. One can supply succulence in the form of root crops such as mangolds. A careful consideration of the case, however, indicates that apparently the fundamental need of the fowls is not for succulence as such, but rather for the tonic effect which is produced by green plants, probably primarily because of the presence of chlorophyll. In feeding fowls for high egg production it is necessary that they be given a ration rich in protein. Only fowls of strong constitution, and with thoroughly sound digestive systems, can handle the heavy laying rations carrying meat scrap and other protein concentrates, which are now so widely used by poultrymen for egg production with successful results. On these heavy rations there is always a tendency for the birds' livers to become impaired in function, and ultimately to become enlarged and diseased. As the matter has been studied here it would appear that one of the chief functions of green food in the ration is to counteract this tendency of the digestive system, and especially the liver, to break down under the strain of handling heavy laying rations over a long period of time. It would appear that the green food given to poultry acts primarily rather as a mild tonic than as a food in the proper sense. There seems to be very little of this tonic effect produced from succulent non-green foods like mangolds.

The practical problem then becomes to devise a system which shall insure a supply of green food for the birds at all seasons of the year. The following system of rotation in the green food supply has been in use for several years on the poultry plant here with satisfactory results. It should be said that, owing to the small area of ground available for the poultry

work at the Station in relation to the number of birds it is necessary to carry, green food must be added to the ration practically throughout the year, not only for the adult fowls in the laying houses, but also for the chicks growing on the range.

Beginning in the early fall when the pullets are put in the laying house they are given green corn fodder cut fine in a fodder cutter. Stalks, leaves and ears are cut together in pieces averaging about 1-2 inch in length. The birds eat this chopped corn fodder greedily. It is one of the best green foods for poultry that we have yet been able to find. Its usefulness is limited only by the season within which it is possible to get it. The feeding of corn fodder is continued until the frost kills the plants.

When the corn can no longer be used cabbage is fed. The supply of this usually lasts through December. In the event of the supply of cabbage failing before it is desirable to start the oat sprouter* the interval is filled out by the use of mangolds. From about January 15 to May 15 green sprouted oats from the source of green food. From about May 15 until the corn has grown enough to cut, fresh clover from the range is used. During the summer the growing chicks on the range are given rape (Dwarf Essex) and green corn fodder cut as described above, to supplement the grass of the range, which rather rapidly dries out and becomes worthless as a source of green food under our conditions. The very young chicks in the brooders are given the tops only of green sprouted oats chopped up fine.

Dwarf Essex rape is an excellent source of green food for poultry but it must be fed with great caution to birds which are laying because if eaten in any considerable amounts it will color the yolks of the eggs green with disastrous results in the market.

THE PREPARATION OF GREEN SPROUTED OATS.

Green sprouted oats have been very widely exploited in recent years as a green food for poultry. There are some so-called "poultry" systems on the market which really consist of

*For description of the method of sprouting oats used at the Station see below.

very little else than the use of this food. The first experiments with this material at the Maine Agricultural Experiment Station were not satisfactory. It was found difficult to get the oats to make a sufficiently quick growth. Experience here has indicated that in order to make a satisfactory green food the oats must be grown very quickly. In order to get quick growth it is necessary to have three things:—first, warmth; second, plenty of moisture; and third, sunlight. After a number of experiments to get the right combination of these three factors the plan to be described was finally worked out and has proved very satisfactory.

There is in connection with the poultry plant a hot water heating system which has a 3-inch out-go pipe. This out-go pipe as it leaves the heater passes along the rear wall of a small room which was formerly used as a grain storage room. To provide a place in which to sprout oats the back part of this room was partitioned off as a closet inclosing the 3-inch hot water pipe. The partition wall which forms the front of this closet consists of glass doors, made from regular storm window sash, hinged so as to swing open as an ordinary door does. These glass doors face towards the south side of the building which has a window directly in front of the doors. Throughout the day the closet gets plenty of light. The dimensions of this sprouting closet are as follows:—

Length	9 ft. 3 inches
Depth	2 ft. 6 inches
Height	6 ft.

The place of shelves in this closet is taken by large, square green-house flats made of 7-8-inch stuff. These flats have the following dimensions:—

Length	2 ft. 5 inches (inside)
Breadth	2 ft. 5 inches (inside)
Depth	2 inches (inside)

The length of the closet is such as just to accommodate three tiers of these flats, which slide on supports so that they can be moved in or out or turned around to suit the convenience of the operator, and the needs of the sprouting grain. These flats set

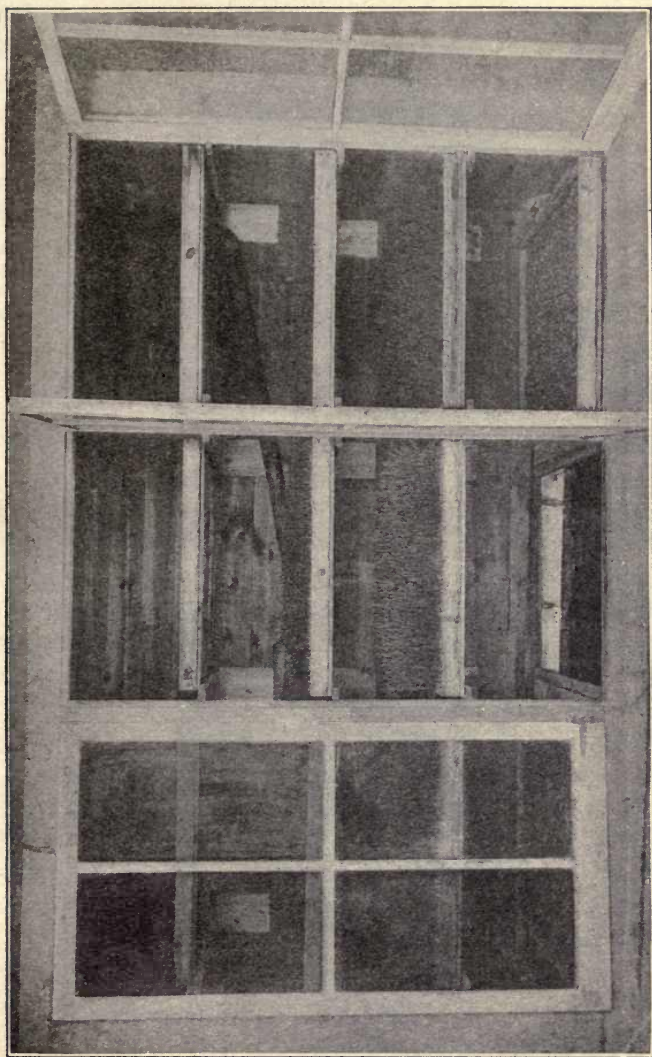
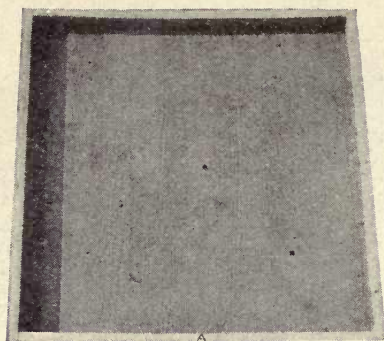
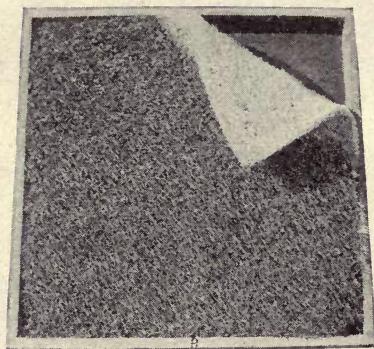


FIG. 13. Green Food Grower.

15 inches apart (i. e., vertically). There can be accommodated four rows of flats, three in a row, in the closet at one time. A number of holes are bored in the bottom of each one of the flats in order to drain off the surface moisture which comes with the wetting of the oats.



A



B

FIG. 14. A, empty flat. B, started to sprout.

The arrangement of the sprouting closet and the flats is shown in Figs. 13 and 14.

The advantage of the closet arrangement described is that it enables one to control the three necessary factors of heat, mois-

ture and light, quite completely. In this closet it is easily possible to maintain a temperature which does not run at any time below 70 degrees. The closet being perfectly tight it is possible to saturate the air with moisture quite easily and virtually convert the whole space into a great moist chamber. With this arrangement one is able to grow oats from 4 to 6 inches high in one week's time. The only difficulty with which one has to contend is the matter of mould. There is always a tendency for the oats to mould in the sprouting process. The only way in which it has been found possible to control this mould is by thoroughly cleaning the flats after each time when they are used. After a flat has been emptied it is thoroughly scrubbed with a 50 per cent. solution of formalin (that is, equal parts of commercial formalin and water). Enough formalin is used to soak the flat well. With this precaution, and if the oats are further made to grow rapidly, the mould does not give any trouble whatever.

The actual method of sprouting the oats is as follows: Clean and sound oats are soaked in water over night in a pail. The next morning flats are filled to the depth of about two inches, and put into the sprouting closet. At the beginning freshly filled flats are placed near the top of the closet so as to get the maximum amount of heat, and in that way get the sprouts started at once. During the first few days, until the sprouts have become from a half to three-quarters of an inch long, the oats are thoroughly stirred and raked over at least two or three times during the day. This stirring insures an even distribution of moisture throughout the mass of oats in the flat. After the sprouts become sufficiently long so that the oats form a matted mass it is not desirable to stir them, or to disturb them in any way. Stirring at that time will break off and injure the sprouts and the green portion above the mass will not grow so well. The matter of prime importance in growing the oats successfully has been found to be sufficient moisture. The tendency at first is to use too little moisture. The oats should be kept quite wet. The aim here is to keep condensed moisture standing on the glass doors which form the front of the closet at all times. In order to do this it is found necessary to wet the oats three times a day. This is done with an ordinary greenhouse sprinkling can, with very little expenditure of time or

labor. As the oats grow the flats are moved to different positions in the closet. The taller the green material gets the nearer the flats are moved towards the floor, because the growing grain then needs less heat. This procedure leaves the desirable places in the closet for the grain just beginning to sprout where high temperature is needed.

The oats are fed when they are from 4 to 6 inches in height. They are fed at the rate of a piece of the matted oats and attached green stalks about 6 to 8 inches square for each 100 birds per day. In feeding, this 6 to 8-inch square piece is broken into smaller pieces and scattered over the pen, so to ensure that all the birds shall have an opportunity to get some. Fed at the rate indicated, this material has never caused any bowel trouble among the birds.

It should be clearly understood that the purpose for which green sprouted oats are fed is their tonic and stimulative influence on the digestive organs. They are not fed for the food value of the oats themselves. If one wishes merely to feed oats they can be most economically fed not sprouted. The point of sprouting is to furnish fresh, succulent, *green* food during the winter months.

HOUSING THE HENS.

When work in poultry management was first undertaken at the University of Maine, the hens were kept in small colonies in accord with what was at that time believed to be the best practice. Houses 10 feet square were erected with the idea of accommodating about 15 birds each. Although the houses were well warmed they were apt to be damp and lined with white frost in very cold weather, when the windows had to be kept shut to protect the birds from cold at night. Another disadvantage of this kind of house is its small size. A person can not care for hens in such small pens without getting them into a condition of unrest for fear of being cornered in such a small room. The question of extra labor in caring for hens in these small colonies scattered over quite a large area is an important factor in a commercial plant. When the Maine Station began experiments in 1897 a warmed house 150 feet long by 16 feet wide was erected. This house was burned the next spring, but was replaced by another of the same kind. This warmed

house, while constructed after the most approved model of the time, was never a satisfactory house for laying hens. For some years it was used only for the keeping of surplus stock and for carrying cockerels over the winter. Finally it was abandoned entirely in favor of curtain-front houses to be described below.

THE ROOSTING-CLOSET HOUSE.

Fourteen years ago one of the 10-foot square houses described above was taken for a nucleus and an addition made, so that the reconstructed house was 10 feet wide and 25 feet long. The inside end of the old house was taken out, so that there is one room with a floor space of 250 square feet. The walls are about 5 1-2 feet high in the clear inside of the building. The whole of the front wall is not filled in, but a space 3 feet wide and 15 feet long is left just under the plate. This space had a frame covered with white drilling, hinged at the top on the inside, so that it could be let down and buttoned during driving storms and winter nights, but hung up out of the way at all other times. The cloth of the outer curtain was oiled with hot linseed oil. The roost platform extended the whole length of the back of the room. It was 3 feet 4 inches wide and 3 feet above the floor. The back wall and up the roof for 4 feet was lined and the space filled and packed hard with fine hay. The packing also extended part way across the ends of the room.

Two roosts were used, but they did not take the whole length of the platform, a space of 4 feet at one end being reserved for a crate where broody hens could be confined until the desire for sitting was overcome. The space, from the front edge of the platform up to the roof was covered by frame curtains of drilling, similar to the one on the front wall, except that it was not oiled. They were hinged at the top edge and kept turned out of the way during the daytime, but from the commencement of cold weather until spring they were closed down every night after the hens went to roost. The hens were shut in this close roosting closet and kept there during the night, and were released as early in the morning as they could see to scratch for grain which was sprinkled in the 8-inch deep straw on the floor.

This building was used through five winters with 50 hens in it. The birds laid as well as the others in the large warmed house; their combs were red and their plumage bright, and they gave every evidence of perfect health and vigor. While they were on the roosts they were warm. They came down to their breakfasts and spent the day in the open air. Such treatment gives vigor and snap to the human being, and it seems to work equally well with the hen.

This house was given the name of the "pioneer" house.

THE ABANDONMENT OF THE ROOSTING CLOSET.

When the curtain-front house was first devised it was thought essential to provide such a roosting closet as described above to conserve the body heat of the birds during the cold nights when the temperature might go well below zero. Experience has shown, however, that this was a mistake. Actual test shows that the roosting closet is of no advantage, even in such a severe climate as that of Orono. On the contrary the birds certainly thrive better without the roost curtain than with it. It has been a general observation among users of the curtain front type of house that when the roost curtains are used the birds are particularly susceptible to colds. It is not hard to understand why this should be so. The air in a roosting closet when it is opened in the morning is plainly bad. The fact that it is warm in no way offsets physiologically the evils of its lack of oxygen and excess of carbon dioxide, ammoniacal vapors and other exhalations from the bodies of the birds.

For some time past it has been felt that the roosting closet was at least unnecessary, if not in fact a positive evil. Consequently the time of beginning to close the roost curtain in the fall has been each year longer delayed. Finally in the fall of 1910 it was decided not to use these curtains at all during the winter. Consequently they were taken out of the houses, or spiked to the roof as the case might be. The winter of 1910-11 was a severe one. On several occasions the temperature dropped to 30 degrees below zero. Yet during this winter the mortality was exceptionally low and the egg production exceptionally high. The roost curtain will not again be used at this Station.

CURTAIN-FRONT HOUSES.

The result of the use of the "pioneer" house indicated that this was essentially a correct system of treating and housing hens, and it was decided to build several houses on the same plan and join them together under one roof as one house.

A curtain-front house 12 feet wide by 150 feet long, known as house No. 2, was erected in 1903. The back wall is 5 feet 6 inches high from floor to top of plate inside, and the front wall is 6 feet 8 inches high. The roof is of unequal span, the ridge being 4 feet in from the front wall; and the height of the ridge above the floor is 9 feet. The sills are 4 by 6 inches in size and rest on a rough stone wall laid on the surface of the ground. A central sill gives support to the floor. The floor timbers are 2 by 8 inches in size and are placed 2 feet apart; the floor is of two thicknesses of hemlock boards. All the rest of the frame is of 2 by 4 inch stuff. The building is boarded, papered, and shingled on roof and walls. The rear wall and 4 feet of the lower part of the rear roof are ceiled on the inside of the studding and plates, and the space between inner and outer walls is packed very hard with dry sawdust. In order to make the sawdust packing continuous between the wall and roof, the wall ceiling is carried up to within 6 inches of the plate; then follows up inclining pieces of studding to the rafters, the short pieces of studding being nailed to the studs and rafters. By this arrangement there are no slack places around the plate to admit cold air. The end walls are packed in the same way. The house is divided by close-board partitions into seven 20-foot sections;* one 10-foot section is reserved at the lower end for a feed-storage room.

Each of the 20-foot sections has two 12-light outside windows screwed to the front, and the space between the windows (which is 8 feet long) for a distance of 3 feet down from the plate is covered during rough winter storms and cold nights by a light frame covered with 10-ounce duck, oiled and closely tacked on. This door, or curtain, is hinged at the top and swings in and up to the roof when open.

*The house is now used as a breeding house, and temporary partitions divide each of the 20-foot pens into two 10-foot pens.

In the front of each section is a door 2 feet 6 inches wide. The roost platform is at the back of each room and extends the whole 20 feet. The platform is 3 feet 6 inches wide and 3 feet above the floor. The roosts are of 2 by 3 inch stuff placed on edge and are 10 inches above the platform. The back one is 11 inches out from the wall, and the space between the two roosts is 16 inches, leaving 15 inches between the front roost and the front of the platform.

Six trap nests are placed at each end of each room. They are put near the front so that the light may be good for reading and recording the numbers on the leg bands of the birds. Several shelves are put on the walls 18 inches above the floor for shell, grit, bone, etc. The doors which open from one room to another throughout the building are frames covered with 10-ounce duck, so as to make them light, and are hung with double-action spring hinges. The advantages of having all doors push from the person passing through are very great; otherwise they would hinder the passage of the attendant with his baskets and pails. Strips of old rubber belting are nailed around the studs which the doors rub against as they swing to, so as just to catch and hold them from being opened by the wind. Tight board partitions are used between the pens instead of wire, so as to prevent drafts. An outside platform 4 feet wide extends along the entire front of the building.

This house accommodates 350 hens—50 in each 20-foot section—is well made of good material, and should prove to be durable. A rougher building, with plain instead of trap nests, and with the roof and walls covered with some of the prepared materials instead of shingles, could be built for less money, and would probably furnish as comfortable quarters for the birds.

Curtain front house No. 3 was constructed in 1904. It is 16 ft. wide by 120 ft. long and is of the same style as No. 2 except that it is wider. There are four pens in the building, each 16 ft. wide by 30 ft. long. The pens are arranged to hold from 125 to 150 hens each, depending on the exigences of the experimental work. One hundred and fifty birds per pen do very well in these pens. Unless there is special reason for it, it is usually preferred to put but 125 birds in each pen. The interior of one pen in this house is shown in Fig. 16.

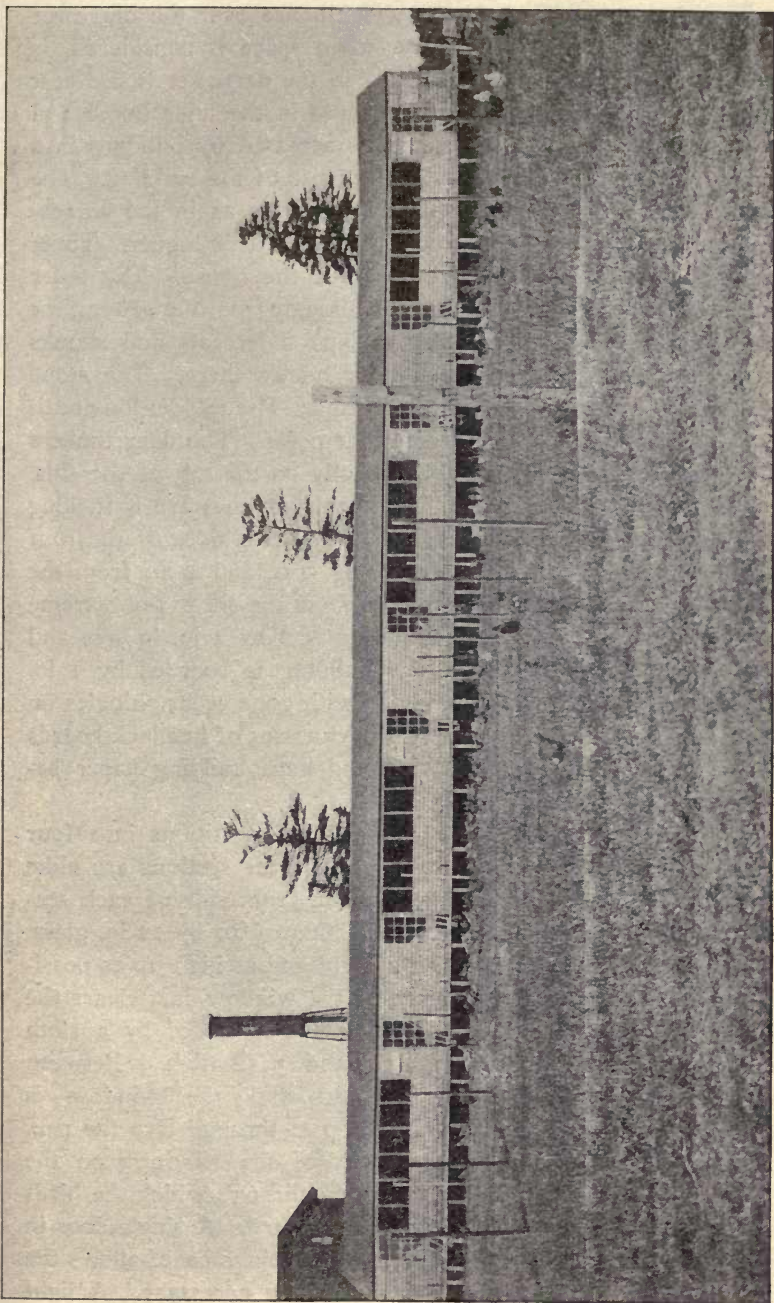


FIG. 15. Curtain-front poultry house No. 3.

The economy in cost of the wider house over the narrower one like No. 2 described above, when space is considered, is evident. The front and back walls in the narrower house cost about as much per linear foot as those in the wide house and the greatly increased floor space is increased by building in a strip of floor and roof running lengthwise of the building. The walls, doors, and windows remain the same as in the narrow house, except that the front wall is made a little higher. Three six inch square sills run lengthwise of the house. The outer ones rest on rough stone walls high enough from the ground for dogs to go under the building to look after rats and skunks that may be inclined to make their homes there. The stone walls rest on the surface of the ground. The middle longitudinal 5 in. x 6 in. timber rests on cedar posts. The floor timbers are 2 by 6 inch in size and rest wholly on the top of the sills. All wall studs rest on the sills. The front ones are 8 ft. long and the back ones 7 ft. 3 in. long. The two sides of the roof are unequal in width, the ridge being 5 ft. and 4 in. from the front wall. The height of the ridge from the sill to the extreme top is 11 ft. and 2 in. All studding is 2 by 4 in. in size and the rafters are 2 by 5 in. The building is boarded by 1 in. boards and is papered and shingled with good cedar shingles on walls and roof. The floor is two thicknesses of hemlock boards which break joints in the laying and have building paper between.

The building is divided by tight board partitions into four sections, each being 30 ft. long. All of the sections are alike in construction and arrangement. The front side of each section has two storm windows of 12 lights of 10 by 12 in. glass. These windows are screwed on upright and as high up as possible on the front, so that the top of the window just clears the eaves. The opening in the front which is closed by a cloth curtain is 14 ft. and 6 in. long and 3 ft. high. Between one end of this curtain opening and the window is placed a door for the attendants to pass through into the pen. A small door is placed under each of the windows on the front side of the house with a runway through which the birds may pass under the front walk into the yard. A single door in the center of the back wall under the droppings board allows the birds to pass out into the back yard when necessary. A light

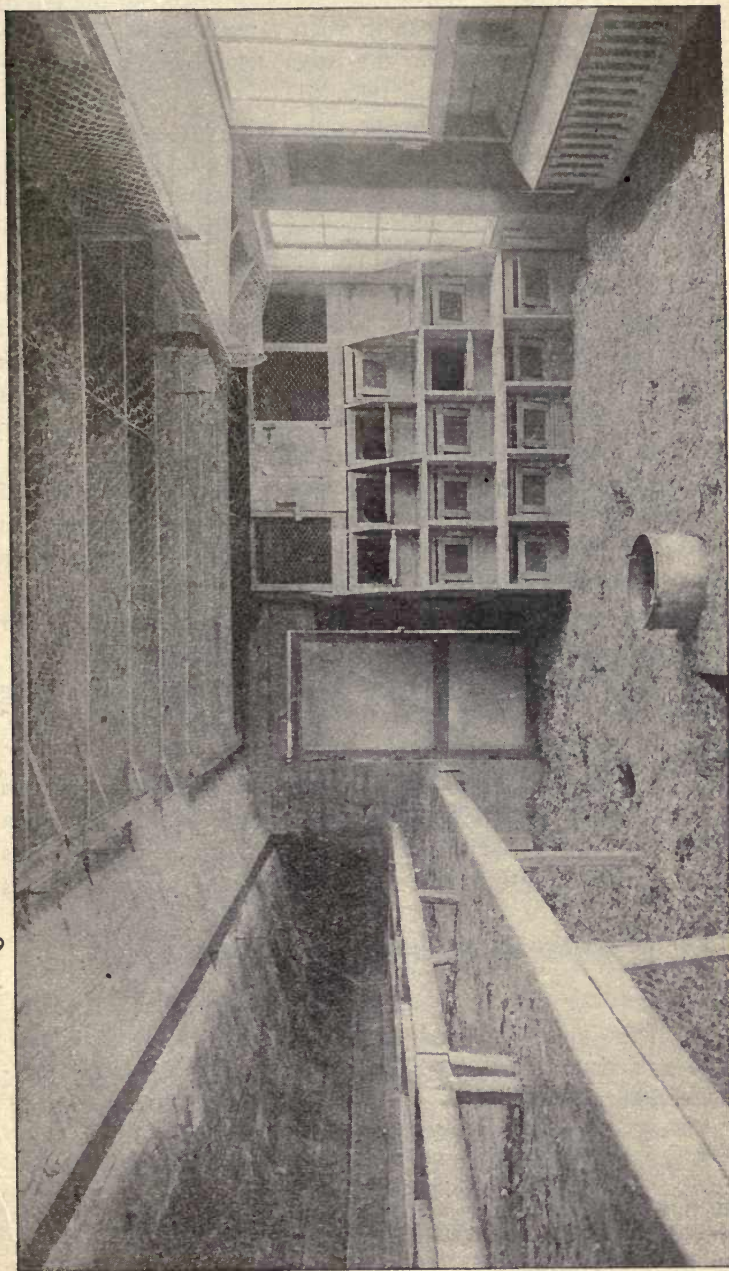


FIG. 16. Interior of curtain front poultry house No. 3.

frame covered with 10 ounce white duck is hinged to the top of the front opening and covers it when closed down. This curtain is easily turned up into the room, where it is caught and held by swinging hooks until released.

The roost platform is made tight and extends along the whole length of the room against the back wall. It is 4 ft. 6 in. wide and 3 ft. above the floor, being high enough for a person to get under comfortably when necessary to handle or catch the birds. There are 3 roosts framed together in two 15 ft. sections. The tops of the roosts are 8 1-2 in. above the platform and hinged to the back wall so that they may be turned up out of the way when the platform is being cleaned. The back roost is 7 in. from the wall and the spaces between the next two are 16 in. They are made of 2 by 3 in. spruce lumber on edge with the upper corner rounded off.

In every pen there is a door placed 5 in. out from edge of the roost platform. Fifteen trapnests are placed in three tiers against the partition in each end of the room. The trapnests are described in a subsequent section of this bulletin.

Troughs similar to those described on page 40 are used for feeding mash, shell, bone, grit, and charcoal.

There is a walk outside of the building which extends along its entire front. It is 4 ft. and 8 in. wide and made of 2 in. planks and is on the level of the floor of the building.

Detailed working drawings and specifications for one section or unit of this curtain front house follow. From these data anyone can figure what the cost of building one of these houses of any desired length at the prices of building material in his locality.

Material needed for one unit of curtain front house:

LUMBER.

(Spruce is specified simply because that is the material actually used in the building described. Any other equally strong lumber may be used. Amounts are given in board feet unless otherwise specified.)

The following estimates do not allow for waste in cutting:

- 9 cedar posts, 6 feet long, 6-inch butts.
- 270 feet 2 by 4 inch spruce for studs, door, window, and coop frames.
- 550 feet 2 by 6 inch plank for floor joists, outside walk, etc.
- 370 feet 6 by 6 inch spruce for sills.
- 40 feet 4 by 4 inch spruce for corner studs and wall stringers.

- 70 feet 2 by 3 inch spruce for roosts, etc.
- 235 feet 2 by 5 inch spruce for rafters.
- 115 feet 1 by 7 inch spruce for rafter braces.
- 33 feet 1 by 9 inch spruce for doors.
- 10½ feet 1 by 6 inch spruce for door braces.
- 3200 feet boards for outside, floor, nests, etc.
- 20 linear feet 2 in. x 2 in. planed to 1 3-4 in. x 1 3-4 in.
- 12 linear feet 2 in. by 3-4 in. spruce.
- 66 board feet 1 in. spruce for feed and grit trough.
- 35 linear feet spruce for curtain frames.
- 20 laths.
- 12,000 shingles.
- 11 feet boards, spruce, for roost frames.

HARDWARE.

- 4 pr. heavy 6 inch T hinges with screws.
- 4 pr. light 3 inch T hinges with screws.
- 2 pr. 3 by 3 inch butts with screws.
- 60 pr. 2 by 2 inch butts with screws.
- 40 lbs. 3 penny shingle nails.
- 100 lbs. 8 penny common nails.
- 35 lbs. 10 penny common nails.
- 15 lbs. 20 penny common nails.
- 2 lbs. 3 penny common nails.
- 1 lb. 3 inch staples.
- 2 thumb latches complete with screws.

MISCELLANEOUS.

- 2 storm windows, 12 lights 10 by 12 inch.
- 6 squares building paper.
- 10 feet 42 inch poultry netting.
- 14½ feet 42 inch 10-ounce duck.

ADVANTAGES OF CURTAIN FRONT HOUSES.

The "Pioneer House" was in use for 5 years with 60 pullets in it each year. No. 2 house has been in use 9 years and the No. 3 house 8 years. No. 2 and No. 3 houses have proven entirely satisfactory, especially No. 3. This is the type of house described in the present bulletin which the Station after 8 years experience feels warranted in recommending. Some years ago the experiment was tried of building a house on the same general plan as that of No. 3 but making it 20 ft. wide instead of 16 ft. wide with the pens 20 ft. long. This house was given a trial for a number of years on a private plant in Orono, but

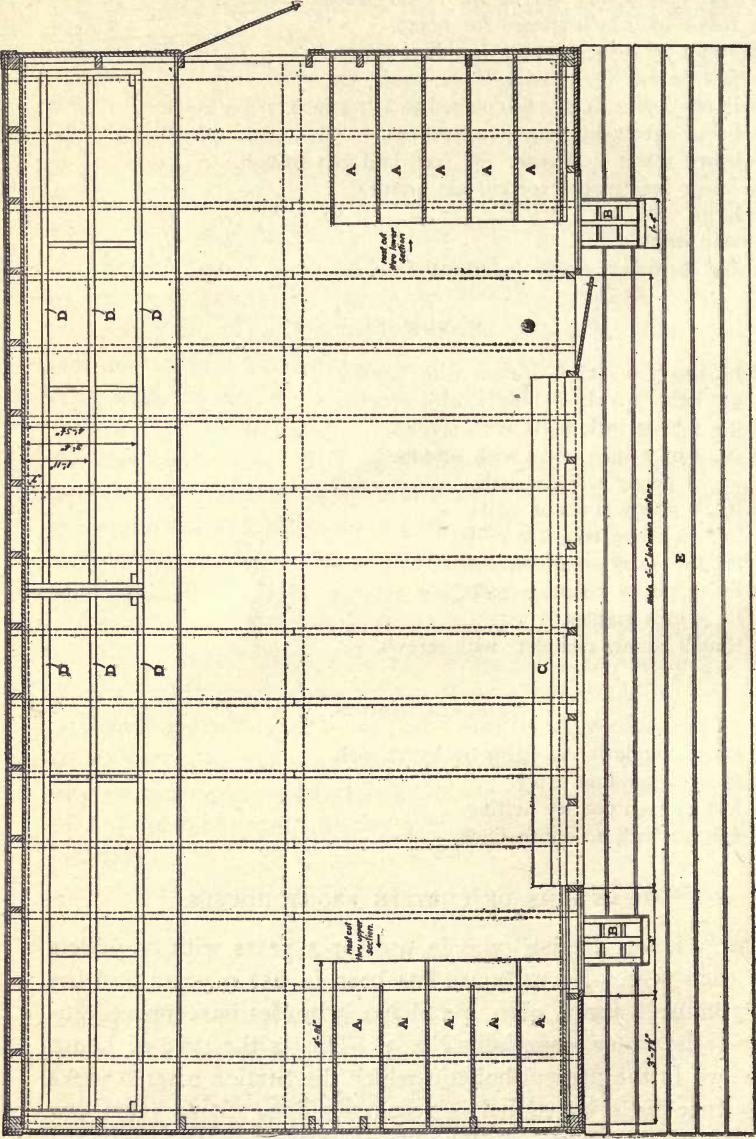


FIG. 17. Floor plan of one unit of No. 3 curtain front poultry house. In this and the following four figures the significance of the letters is as follows: A.—trap nests. B.—runways to yards. C.—dry mash trough. D.—roosts. E.—walk. F.—front opening. G.—coop for broody hen. H.—spike to hang green food on. I.—grit trough. J.—curtain front.

from all that can be learned the house was never so satisfactory as the 16 ft. house at the Station, and has finally been abandoned.

Maine is subject to long spells of severe cold weather, with the temperature considerably below zero at night, and about zero during the day, and with a good deal of high wind. During such rough weather the bedding on the floor has kept comparatively dry. The yields of eggs during severe weather and immediately following it are rarely below those immediately preceding it. It should be borne in mind that had the weather been mild all that time the hens probably would have increased in production rather than remained stationary. They are doubtless affected by the severe weather, but not seriously, as they uniformly begin to increase in production very soon after the weather becomes normal for midwinter.

These curtain front houses have all proved eminently satisfactory. The egg yields per bird have been better in these houses than in warmed ones. The purpose of having rooms and flocks of different sizes was to compare the welfare and egg yields of the birds under the different conditions.

THE YARDS.

The yards to most poultry houses are at the south, or on the sheltered sides of the buildings, to afford protection during the late fall and early spring, when cold winds are common. The warmed house had yards on both north and south sides, with convenient gates. This is a highly desirable arrangement since it permits the alternate use of the two sets of runs. In this way trouble from soil contamination may be avoided. The south yards were used until the cold winds were over in spring, when the hens were allowed to go to the north yards, which were well set in grass sod. The birds are kept shut in the curtain front house until the weather is suitable and the ground dried out in the spring. The necessity for getting them out of the open-front house, where they are really subject to most of the out-of-door conditions during the daytime, is not so great as when they are confined in closed houses with walls and glass windows. The clear, open fronts of the curtain-front houses

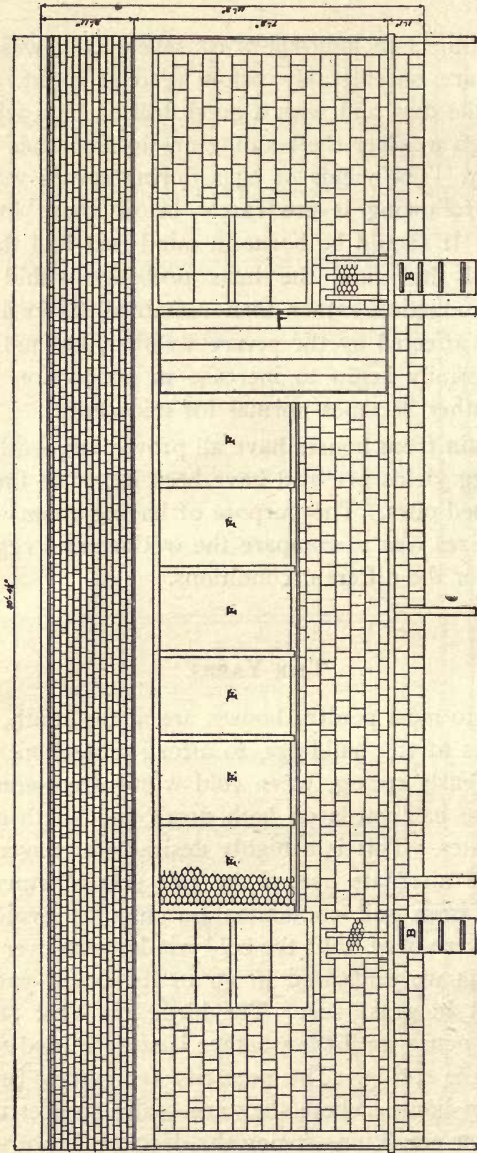


FIG. 18. Front elevation of one unit of No. 3 curtain front poultryhouse. Letters as in Fig. 17.

allow teams to pass close to the open doors of the pens for cleaning out worn material and delivering new bedding, and also allow attendants to enter and leave all pens from the outside walk and reach the feed room without passing through intervening pens.

LICE.

One of the most difficult and trying problems which the poultry keeper has to meet is that of keeping his poultry houses and stock reasonably free from lice, mites and other external parasites. There are many proprietary preparations on the market designed to accomplish this end in one way or another. Most of these preparations are, in proportion to their efficiency, very expensive. Many of them have been tried at the Maine Experiment Station. The Station has finally, however, come to follow the procedure outlined in this circular to the exclusion of all others, and with results which are extremely satisfactory. Indeed, it may be said that vermin on the poultry or in the houses no longer cause any appreciable annoyance in the work of the Station plant.

The routine method which the Station uses in handling its stock with reference to the lice problem is as follows:—

All hatching and rearing of chickens is done in incubators and brooders. The growing chickens are never allowed to come into any contact whatever with old hens. Therefore, when the pullets are ready to go into the laying houses in the fall they are free from lice. Sometime in the late summer, usually in August or early in September, the laying houses are given a thorough cleaning. They are first scraped, scoured and washed out with water thrown on the walls and floor with as much pressure as possible from a hose. They are then given two thorough sprayings, with an interval of several days intervening, with a solution of cresol such as is described on page 7. Then the roosting boards, nests, floors and walls to a height of about 5 feet are thoroughly sprayed with the lice paint (kerosene oil and crude carbolic acid). Finally, any yearling, or older birds, whether male or female, which are to be kept over for next year's work are given two or three successive dustings, at in-

tervals of several days to a week between each application, with the lice powder described below, before they are put into the cleaned houses.

As a result of these methods the Station's poultry plant is at all times of the year practically free from lice.

In keeping a poultry plant reasonably free from lice there are two points of attack: One, the birds themselves; the other, the houses, nest boxes, roosting boards, etc. For the birds themselves experience has shown that the best way to get rid of the lice is by the use of a dusting powder to be worked into the feathers. In using any kind of lice powder on poultry it should always be remembered that a single application of powder is not sufficient. When there are lice present on a bird there are always unhatched eggs of lice ("nits") present too. The proper procedure is to follow up a first application of powder with a second at an interval of 4 days to a week. If the birds are badly infested at the beginning it may be necessary to make still a third application. To clean the cracks and crevices of the woodwork of houses and nests of lice and vermin a liquid spray or paint is probably the most desirable form of application.

The most efficient lice powder known to the writer is that invented by Mr. R. C. Lawry, formerly of the Poultry Department of Cornell University. This powder is made by incorporating the liquid mixture of

3 parts of gasoline
1 part of crude carbolic acid

in sufficient plaster of paris to take up all the moisture.

Two difficulties have arisen regarding the practical utility of the powder as above described. In the first place a great many druggists appear to have a deep-seated and ineradicable prejudice against furnishing their customers *crude* carbolic acid at any price. Reports have reached the Station of druggists making such utterly preposterous and absurd claims as that carbolic acid is a highly explosive substance, which they do not dare to handle! In the second place difficulty has arisen over the fact that there are in the drug trade three grades of crude carbolic acid. Two of these are very much weaker than the other and are quite useless for making the lice powder. The three grades

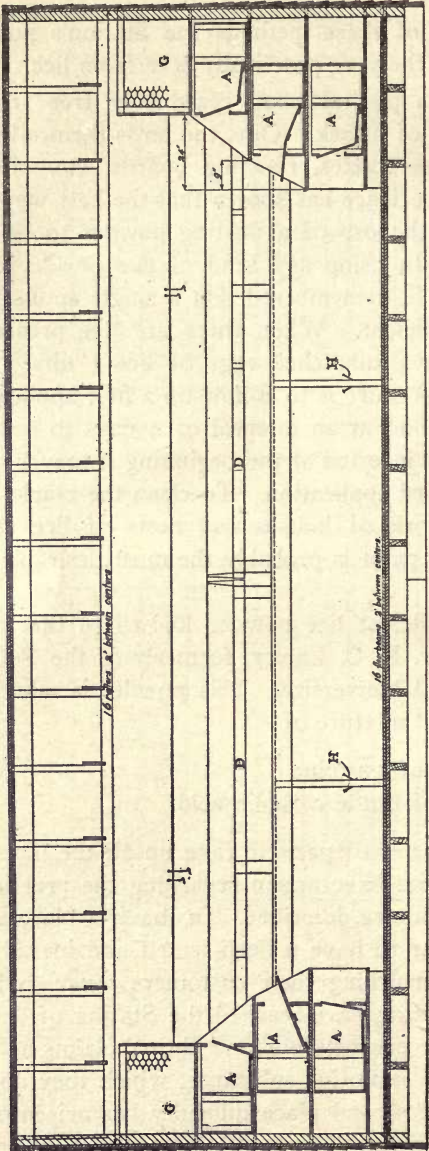


FIG. 20. Longitudinal section of one unit of No. 3 curtain front poultry house. Letters as in Fig. 17.

are listed as follows by a reputable chemical house. These are retail prices.

Acid Carbolic, *Crude*, per gallon 25c.

Acid Carbolic, *Crude* 50-60 per cent., per gallon 40c.

Acid Carbolic, *Crude* 90-95 per cent., per gallon 50c.

To get the proper results *only the 90-95 per cent. should be used for making lice powder.* The weaker acids are ineffective.

Owing to the difficulty in getting the strong crude carbolic acid locally in this State at reasonable prices, the Station has experimented to see whether some other more readily obtainable substance could not be substituted for it. It has been found that *cresol* gives as good results as the highest grade crude carbolic.

The directions for making the powder are, therefore, modified as follows:

Take 3 parts of gasoline, and

1 part of crude carbolic acid, 90-95 per cent. strength,
or, if the 90-95 per cent. strength crude carbolic acid cannot be obtained take

3 parts of gasoline and

1 part of *cresol*.

Mix these together and add gradually with thorough stirring, enough plaster of paris to take up all the moisture. As a general rule it will take about 4 quarts of plaster of paris to 1 quart of the liquid. The exact amount, however, must be determined by the condition of the powder in each case. The liquid and dry plaster should be thoroughly mixed and stirred so that the liquid will be uniformly distributed through the mass of plaster. When enough plaster has been added the resulting mixture should be a dry, pinkish brown powder having a fairly strong carbolic odor and a rather less pronounced gasoline odor. The powder may be passed repeatedly through a sieve to aid in the mixing.

Do not use more plaster in mixing than is necessary to blot up the liquid. This powder is to be worked into the feathers of the birds affected with vermin. The bulk of the application should be in the fluff around the vent and on the ventral side of the body and in the fluff under the wings. Its efficiency, which is greater than that of any other lice powder known to

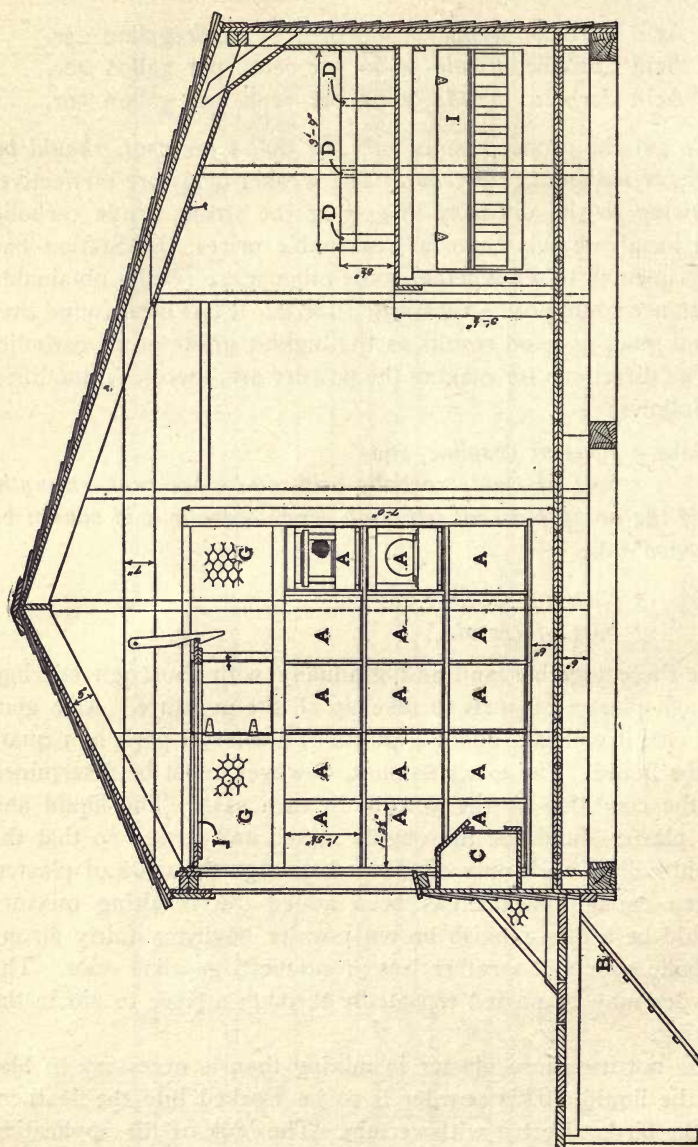


FIG. 21. Cross section of one unit of No. 3 curtain front poultry house. Letters as in Fig. 17.

the writer, can be very easily demonstrated by anyone to his own satisfaction. Take a bird that is covered with lice and apply the powder in the manner just described. After a lapse of about a minute, shake the bird, loosening its feathers with the fingers at the same time, over a clean piece of paper. Dead and dying lice will drop on the paper in great numbers. Anyone who will try this experiment will have no further doubt of the wonderful efficiency and value of this powder.

For a spray or paint to be applied to roosting boards, nest boxes or walls and floor of the hen houses the following preparation is used:—*3 parts of kerosene and 1 part crude carbolic acid, 90-95 per cent. strength.* This is stirred up when used and may be applied with any of the hand spray pumps or with a brush.

If 90-95 per cent. crude carbolic acid cannot be obtained cresol may be substituted for it in this paint.

At the present time very little use of lice powder of any sort is made at the Station. Instead a mercurial ointment is employed when a bird needs individual treatment. After several years experience we find the ointment to be more satisfactory than any powder. The ointment used for this purpose is *Ammoniated Mercurial Ointment*. This is a standard U. S. P. preparation, but as the Pharmacopoeia calls for it to be made with wool-fat or lanolin as a base, and as this is more expensive than other forms of fat equally good for the present purpose we have the druggist make up the ointment exactly as called for by the U. S. P. *except* that lard is substituted for lanolin.

In using this ointment a piece about as big as a pea should be well rubbed into the skin under the vent, and a piece of similar size well rubbed in under each wing. In using a mercurial ointment always spread it around well, so that the bird cannot eat it.

NATURAL ENEMIES OF POULTRY.

One of the chief difficulties that the poultryman has to contend with is the continued loss of chicks, and sometimes even of nearly full grown birds, as consequence of the depredations of natural enemies. It is safe to say that the magnitude of the loss from this source is not anything like fully realized by any one who has not kept an accurate account of all his birds. In

the experimental breeding work with poultry at the Maine Station it is necessary to keep account of every bird on the plant. It has, therefore, on this account been possible to check up and form an adequate estimate of the losses due to the creatures that prey upon poultry. A good deal of attention has been devoted to the problem of how these losses may be cut down and the results of this experience may be of benefit to other poultry keepers.

In the experience of this Station the most destructive natural enemy of poultry in the long run has been found to be the crow. The depredations of the hawks are more spectacular perhaps, but in the long run far less destructive. A hawk will only visit a poultry yard occasionally, and especially if he is shot at once or twice will be very wary about approaching it again. On the contrary the crow is a steady and persistent robber. He will continue his depredations just as long as it is physically possible for him to do so. While there may be some doubt as to whether crows are beneficial or harmful as regards other phases of agriculture, there can be no question that, so far as the poultry man is concerned, the only good crow is a dead one. For a number of years the crows killed and either carried away, or left behind partly eaten, a large number of chicks on the Station poultry plant. The losses were not by any means confined to the small chicks, but half grown birds, each nearly equal in weight to the crow itself, were killed, partly eaten, and left behind on the range.

One after another all the devices which had been suggested by others, or could be thought of by those in charge of the poultry work, were tried in order to stop these ravages. In a single year the crows destroyed something over 500 chicks. One important reason for these heavy losses is the location of our poultry range. It borders upon a pine forest in which the crows congregate in great numbers. In the case of a range farther from the woods the losses, without protection, would not be nearly so heavy. Various sorts of "scare-crows" were tried but with no effect whatever. Dead crows were hung up on stakes about the yards as solemn warnings to their fellows, but instead of operating as warnings they appeared rather to serve as "invitations to the dance." Decoying the birds in various ways so that they might be shot was tried, but with very

slight individual success and no substantial effect on the steady losses. Poisoning is reported to have been used with success in other places, but has never been tried on the Station plant. It is doubtful whether it is justifiable, save under very exceptional circumstances. The point is that it is difficult to manage affairs in such way as to insure that only the crows will get the poison. There are so many useful and valuable animals about the farm that easily might get the poison before the crow did, with a resulting loss greater than that caused by the crow, that it would seem wise to resort to poisoning only when it can be done under well controlled conditions.

The plan which has finally been adopted at the Station poultry plant for dealing with crows is one which is perfectly safe and sure in its operation. It consists simply in running strands of binder twine about two feet apart over the whole of the poultry range occupied by the young birds, until they reach such size that they are able to take care of themselves. These strings are run over the tops of the brooder houses, and on supports made by cross strands of either wire or two or three strings of binder twine twisted together. These cross strands are held up where necessary by posts. The whole network of strings thus formed is put at such height that the attendants in working about the yard, will not hit the string when standing upright. The area covered in with strings in this way on the Station poultry plant is usually about 3 acres per year. The expense of covering this area is from \$15 to \$20 for twine. The labor of putting it up is comparatively small. It forms a perfect and complete protection against both crows and hawks.

The appearance of the range when covered with strings is shown in figure 22.

Next in importance to the predaceous birds, as poultry enemies, stand the rats and the foxes. In times past foxes have destroyed many chickens from the Station's poultry plant. Of late years, however, none has been lost. The protection is afforded by a fox proof fence surrounding the whole plant. Rats may become a very serious pest. They live under the brooder houses and take the young chicks. Various methods have been tried at the Station, but no wholly satisfactory way of dealing with rats has yet been found. Trial was made some years ago of one of the most widely advertised of the bacterial

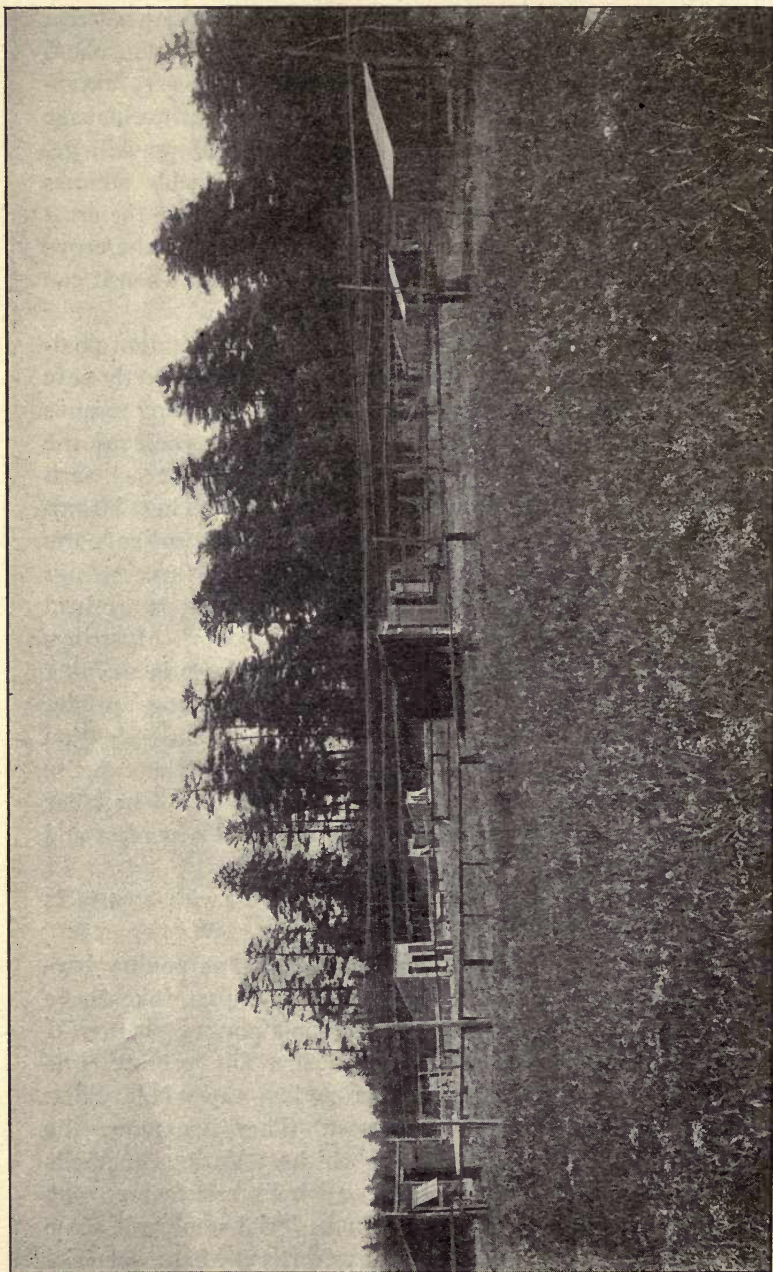


FIG. 22. Showing poultry range in 1913 covered with strings two feet apart, as a protection against crows and other predaceous birds.

rat destroyers, which when fed to rats is supposed to induce a disease which kills them all. No effect whatever was observed to follow the use of this preparation. The rats ate freely of grain which had been moistened with it and if any disease developed as a consequence it has not yet benefited us, or perceptibly inconvenienced the rats. Digging the rats out of their holes and shooting them is one effectual method of dealing with them. Several good cats on the place also aid materially in fighting this pest. A systematic trapping campaign is productive of good results. It must however, be continued without interruption over a considerable period of time. Desultory trapping produces little effect on the rat population. A thorough-going campaign, however, tends to drive the uncaught rats away from the premises.

TRAP NESTS.

In all the experimental work with laying hens at the Maine Agricultural Experiment Station use is made of trap nests. In 1908 a new type of trap nest was devised which has proved extremely satisfactory. The features in which this nest is superior to the type formerly used at the Station are (1) certainty and precision of operation; (2) greater simplicity of construction, with less tendency to get out of order and work badly; (3) saving of labor in resetting the nest after use.

The nest is a box-like structure, without front, end, or cover, 28 inches long, 13 inches wide, and 16 inches deep, inside measure. A division board with a circular opening 7 1-2 inches in diameter is placed across the box 12 inches from the rear end and 15 inches from the front end. Instead of having the partition between the two parts of the nest made with a circular hole, it is possible to have simply a straight board partition extending up 6 inches from the bottom, as shown in figure 23. The rear section is the nest proper.

The front portion of the nest has no fixed bottom. Instead there is a movable bottom or treadle which is hinged at the back end (fig. 23). To this treadle is hinged the door of the nest. The treadle is made of 1-2-inch pine stuff, with 1 1-2-inch hardwood cleats at each end (figs. 24 and 25) to hold the screws which fasten the hinges. It is 12 inches wide and 12 1-4 inches

long. Across its upper face just behind the hinges holding the door is nailed a pine strip 4 inches wide, beveled on both sides, as shown in figures 24 and 25. The door of the nest is not made solid, but is an open frame (figs. 18 and 20), to the inner side of which is fastened (with staples) a rectangular piece of 1-8-inch mesh galvanized screening (dimensions 8 by 9 inches). The sides of the door are strips of 3-4-inch beech stuff 12 inches long and 1 1-2 inches wide, halved at the ends to join to the top and bottom of the door. The top of the door is a strip of hard wood 13 inches long and 1 1-2 inches wide, halved in 2 3-4 inches from each end. The projecting ends of this top strip serve as stops for the door when it closes (fig. 23). The bottom of the door is a hard-wood strip 10 1-4 inches by 4 inches. The side strips are fitted into the ends of this bottom strip in such way as to project slightly (about 1-32 inch) above the front surface of that strip, for a reason which will be apparent.

When the nest is open the door extends horizontally in front, as shown in figure 24. In this position the side strips of the door rest on a strip of beech 1 1-2 inches wide, beveled on the inner corner, which extends across the front of the nest. This beech strip is nailed to the top of a board 4 inches wide, which forms the front of the nest box proper. To the bottom of this is nailed a strip 2 inches wide, into which are set two 4-inch spikes from which the heads have been cut (compare fig. 24). The treadle rests on these spikes when the nest is closed. The hinges used in fastening the treadle and door are narrow 3-inch galvanized butts with brass pins, made to work very easily. It is necessary to use hinges which will not rust.

The manner in which the nest operates will be cleared from an examination of figures 24 and 25 which show a sample nest with one side removed to show the inside. A hen about to lay steps up on the door and walks in toward the dark back of the nest. When she passes the point where the door is hinged to the treadle her weight on the treadle causes it to drop. This at the same time pulls the door up behind her, as shown in figure 25. It is then impossible for the hen to get out of the nest till the attendant lifts door and treadle and resets it. It will be seen that the nest is extremely simple. It has no locks or triggers to get out of order. Yet by proper balancing of door and treadle

it can be so delicately adjusted that a weight of less than half a pound on the treadle will spring the trap. All bearing surfaces are made of beech because of the well-known property of this

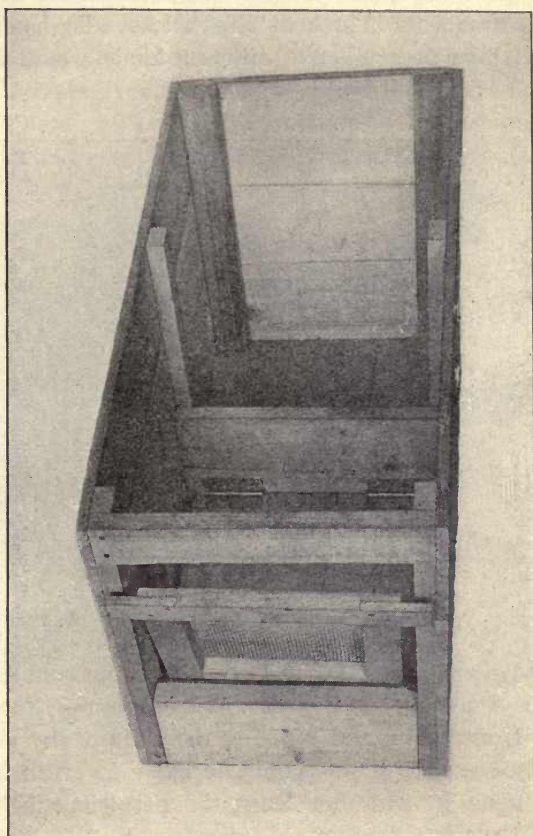


FIG. 23. Trap nest closed. View from above.

wood to take on a highly polished surface with wear. The nests in use at the Maine Station have the doors of hard wood, in order to get greater durability. Where trap nests are constantly in use, flimsy construction is not economical in the long run. For temporary use the nest door could be constructed of soft wood.

The trap nests are not made with covers because they are used in tiers and slide in and out like drawers. They can be

carried away for cleaning when necessary. Four nests in a pen accommodate 20 hens by the attendant going through the pens once an hour, or a little oftener, during that part of the day when the hens are busiest. Earlier and later in the day his visits are not so frequent. The hens must all have leg bands in order to identify them; a number of different kinds are on the market.

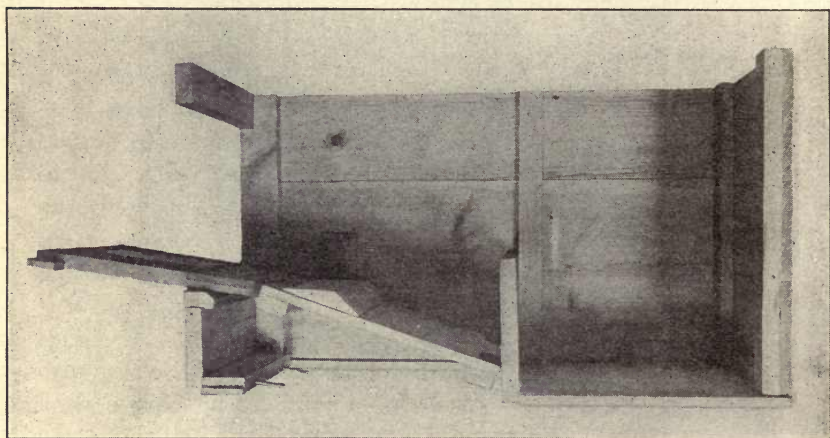


FIG. 24. Trap nest open. One side removed to show method of operation.

The double box with the nest in the rear is necessary. When a hen has laid an egg and desires to leave the nest, she steps out into the front space and remains there until she is released. With only one section she would be likely to crush her egg by stepping upon it, and thus learn the pernicious habit of egg eating.

To remove a hen, the nest is pulled part way out, and as it has no cover she is readily caught, the number on her leg band is noted and the proper entry made on the record sheet. After having been taken off a few times the hens do not object to being handled, most of them remaining quiet, apparently expecting to be picked up.

Before commencing the use of trap nests it was thought that some hens might be irritated by the trapping operation and object to the noise incident to it, but such does not seem to be the case. Trap nests have been used at the Maine Station for

Leghorns, Brahmas, Wyandottes, and Plymouth Rocks and a number of other breeds.

The amount of time required in caring for the trap nests can only be estimated, since the attendant's time is divided with other duties. The time varies from one day to another and with the number of nests in use. By noting the total time used each day in caring for the nests when the hens were laying most heavily, it has been estimated that one active person devoting his entire time to trap nests could take care of 400 to 500 nests used by 2,000 to 2,500 hens. When commencing the year's work he would need assistance in banding the birds, but after that

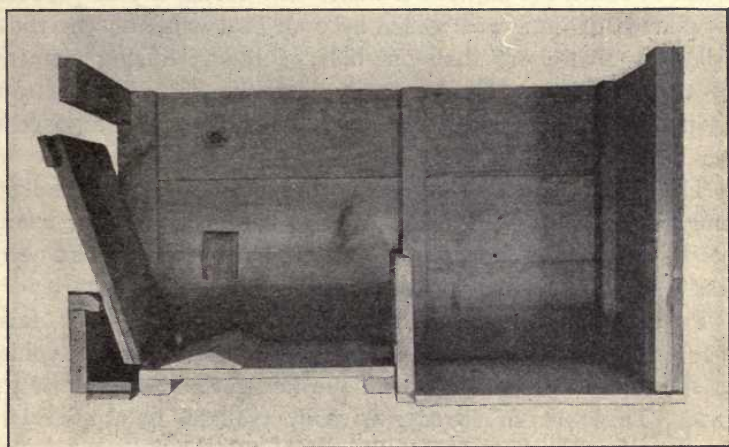


FIG. 25. Trap nest closed. One side removed to show method of operation.

was done he could care for the nests without assistance until midsummer, when the egg yield would probably be diminished and a part of his time could be spared for other duties.

THE VALUE, METHOD OF PRESERVATION, AND ECONOMICAL USE OF HEN MANURE.

One of the most valuable by-products of any live-stock industry is the manure. Its proper care and use is one of the distinguishing features of a successful stock farm. The high nitrogen content of poultry droppings makes them in certain

respects the most valuable of farm manures. At the same time this quality necessitates special treatment to preserve the nitrogen and utilize it economically.

According to experiments carried on at this Station some years ago* the night droppings average 30 pounds per hen per year.

They contain .8 pound of organic nitrogen, .5 pound of phosphoric acid and .25 pound of potash. At the present price of fertilizers this material would be worth about 20 cents. No data are available on the amount of day-voided dung. Since the hens spend less than one-half their time on the roosts, and since more dung is voided while the birds are exercising than when at roost, the authors estimate that during a year probably 45 pounds of dung are voided by each bird while off the roost. Allowing that more than one-half of the fertilizing elements of the day dung are necessarily lost, the value of the total droppings, if properly cared for, should be at least 30 cents per bird per year.

The poultryman or farmer who properly cares for the droppings can add a neat further profit to his business. For example the droppings from 1000 birds, if preserved without needless loss, will be worth at least \$300.

Poultry manure contains more nitrogen than other farm manure, because in birds the excretion of the kidneys is voided in solid form (uric acid), with the undigested portions of the food. This form of nitrogen is easily available to plants. Unfortunately, however, it is not stable. Putriferous processes easily change it to ammonia compounds, and unless special care is taken of the droppings one-third to one-half of the nitrogen passes off as ammonia gas.

The mechanical condition of poultry manure is poor. As Storer† says: "It is apt to be sticky when fresh and lumpy when dry" On this account, if used untreated, it can only be successfully applied to the land by hand, as it does not work well in drills or spreaders. Hen manure used alone is very

*Woods, C. D. and Bartlett, J. M. Ann. Rept. Me. Agr. Expt. Sta. 1903, pp. 199-204.

†Storer, F. H. Agriculture in Some of its Relations with Chemistry. Chas. Scribner's Sons, New York, 1899, Vol. 1.

wasteful of nitrogen as it carries this element in too large a proportion to its phosphorus and potassium.

In the experiments referred to above the problem undertaken by Woods and Bartlett was the determination of a method of treatment of hen manure which would first prevent the loss of nitrogen; second, add sufficient phosphorus and potassium in forms available for plant food to make a balanced fertilizer; and third, so improve the mechanical condition of the dung that it can be applied to the land with a manure spreader. Seven different methods of treatment were tested. The authors give the following summary of their results.

"By itself, hen dung is a one-sided nitrogenous fertilizer. As usually managed, one-half or more of its nitrogen is lost, so that as ordinarily used it does not carry so great an excess of nitrogen. Because of its excess of nitrogen it will be much more economically used in connection with manures carrying phosphoric acid and potash. As both acid phosphate and kainit prevent the loss of nitrogen, it is possible to use them in connection with sawdust or some other dry material as an absorbent (good dry loam or peat will answer nicely) so as to make a well balanced fertilizer. For example, a mixture of 30 pounds of hen manure, 10 pounds of sawdust, 16 pounds of acid phosphate, and 8 pounds of kainit would carry about .25 per cent nitrogen, 4.5 per cent phosphoric acid, and 2 per cent potash, which, used at the rate of 2 tons per acre, would furnish 50 pounds nitrogen, 185 pounds phosphoric acid, and 80 pounds potash."

At the usual prices of fertilizing ingredients this mixture is worth from \$10.00 to \$20.00 per ton. It is a well balanced, stable, fertilizer which, while still not fine enough to work well in drills, can be successfully applied with a manure spreader.

The kind of absorbent used should be the one which can be obtained at least cost, since the amount of plant food added by any of those suggested is negligible, and since they are about equally effective as dryers (the slight acidity of peat gives it some advantage as it helps a little to preserve the nitrogen). It is probably that one of the three can be obtained by any poultryman or farmer at little or no expense.

The absorbent and the acid phosphate and kainit should be kept conveniently at hand and each day when the droppings

are collected they should be treated. It may be best to weigh the ingredients a few times, after which it will be possible to make sufficiently close estimates by measure.

The treated droppings should be well sheltered until time to apply them to the land, i. e., shortly before plowing. Any form of shelter may be used. For a temporary plant, or for a small farm, a small wooden building or a bin in a larger building will probably be the best place practicable; but for a large, permanent poultry plant a cement manure shed or tank is advisable. A general farmer also will find such an equipment for the storage of all farm manure a paying investment. A portion of this shed can be partitioned off for hen manure.

A properly constructed cement building will not have to be constantly repaired and frequently replaced like a wooden structure, which rots out quickly when used for the storage of manure. The cement building is water tight, preventing the entrance of water from without and the escape of any unabsorbed liquid manure. It is, in fact, a perfect permanent shelter.

THE MAINE STATION MANURE SHED.

In 1912 this Station built at its poultry plant a manure shed large enough to accommodate the droppings from one thousand adult birds, over a period of a year, and the droppings collected from the range where about three thousand chicks are annually reared.

The inside measurements of this shed are 12-7 feet. It is 5 feet high at the eaves and 8 feet 2 inches to the peak of the roof. It is illustrated in figures 58 and 59.

The droppings are thrown into the shed through trap doors in the roof, and taken out from one end, which is of removable plank. The other three walls, and enough of this end wall to form the grooves which hold the ends of the planks; the floor; and the foundation are formed of one continuous cement mass (monolithic construction). The gables are board. The gable at the open (plank) end of the shed is removable to give more head room, when shoveling the manure into carts. It is held in place by hooks.

It was necessary to place this building on a very heavy clay soil which heaves badly with frost. For this reason it was

placed on a much deeper foundation than would be necessary in a more favorable location. The foundation is a solid block of cement and rock, the size of the outside measurements of the shed and extending five feet below the surface of the ground.

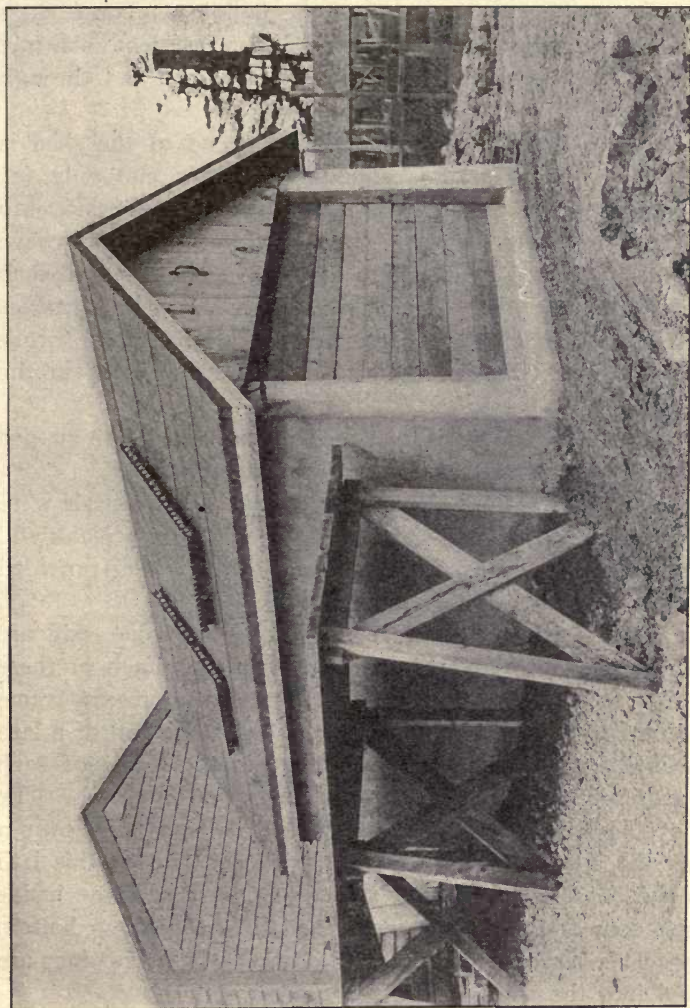


FIG. 26. Photograph of manure shed on poultry plant of Maine Agricultural Experiment Station. Note walk, trap-doors in roof, plank end, and removable gable.

It was made by using as many rocks and as little cement as was consistent with the formation of a firm solid mass. For a few inches near the top, however, clear cement was used and

this was smoothed off at ground level to form the floor. At the edges of this foundation the cement was continued up into the wall forms which were built so that the walls are ten inches thick at the base and six at the top.

An iron bar ending in a ring was set in the cement near the top of the wall at each corner of the building. These rings project a few inches from the end walls. The roof is firmly secured to the walls by bolts passing through it and through these rings.*

As stated above the larger part of one end of the shed is plank. The cement wall is continued on this end only far enough from either corner to provide a place for the slot into which the planks are slipped. This slot is formed by a groove two inches deep and a little more than two inches wide in each end of the cement wall. See Figs. 26 and 27. These grooves were formed by placing angle iron posts within the board forms.

This completes the description of the cement work in the building.

The removable end is of two inch planks which are slipped into the above described slot in the cement wall.

The plates and rafters are of 2x4 timbers. Inch boards were used for roof boards, gables, etc. The gable on the plank end is removable. It is held in position by hooks and is provided with a handle in the center.

The roof is covered with roofing paper. In one side are two trap doors also covered with this roofing. Each of these doors is 2 feet 4 inches x 2 feet 10 inches and fits over a frame in the roof to which it is hinged at the top. The end of a lath is attached by a double screweye hinge to the inside of each door at the right edge about half way from bottom to top. The edge of the lath is provided with notches which hook over a nail on the inside of the door frame. When hooked this lath holds the door open. A 2x4 strip is nailed across the inside of each door frame a little more than half way from bottom to top. This serves as a rest for the basket when droppings are emptied into the shed.

This shed is placed at the end of the line of poultry houses. The wide raised walk which extends along the entire front of

*This is an awkward and unnecessary arrangement, and was only used through a misunderstanding on the part of the builder.

the houses is continued past the shed as a 2-foot walk. Between the last poultry house and the shed the walk is built on an incline so that at the end of the shed it is only 1 foot 8 inches from the eaves. This is a convenient height from which to reach the doors with the baskets of droppings.

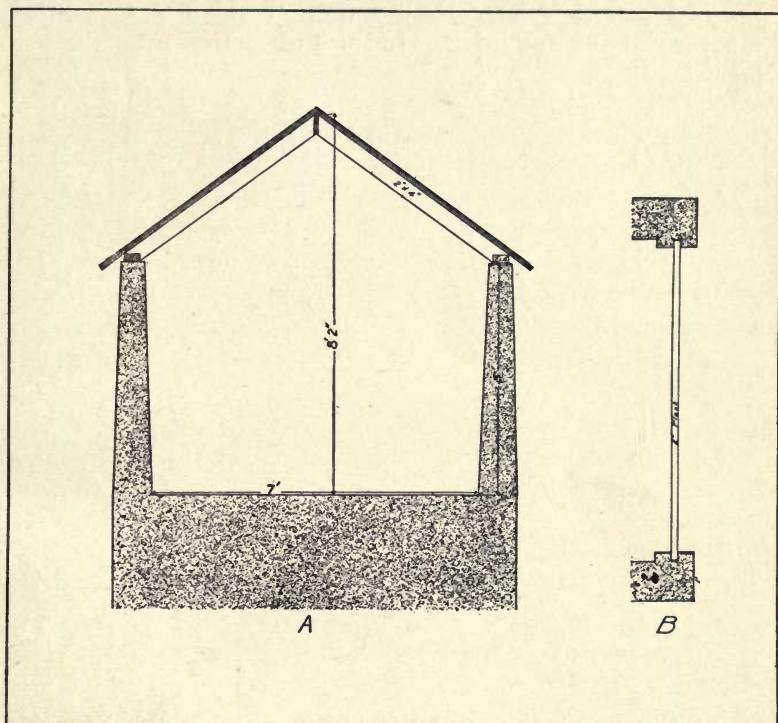


Fig. 27. A. Cross section of manure shed, showing dimensions and plan of construction. B. Horizontal section of front, showing planks in the grooves in the cement walls.

The Cost of the Shed.

Cement	\$45.60
Gravel	20.00
Inch boards	17.50
2x4 timber	13.00
2 in. plank	1.20
Finishings	10.00
Roofing	8.00
Labor	70.00

\$185.50

On many large poultry plants little or nothing is received for the manure. Probably few poultry plants save more than one-half the fertilizing elements possible, if proper methods of treatment and shelter were used. If the droppings are treated by the methods described above, and are kept properly sheltered, the saving on any large poultry farm would in 1 to 3 years easily equal the cost of a permanent shed similar to the one here described.

